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THE FROST.

So much regret has been expressed at our intention to omit further reference to this subject in the *Meteorological Magazine*, that we have made a compromise. As originally proposed, we have passed on to Mr. Charles Harding for the paper which he will read at the meeting of the Royal Meteorological Society, on February 18th, all the notes and memoranda which we have been able to collect. But we have prepared from the English and Continental Daily Weather Reports the tables given on two following pages, as our contribution towards the record of the frost.

It will be seen that we have taken only one single element—the lowest temperature on each day, at twenty localities very widely spread over Western Europe, and including also Algiers, as it has now a large influx of European visitors during the winter.

The temperatures are, as will be seen, given merely to the nearest degree, and that is the reason for some entries which, as far as we know, are new to meteorology, viz.: **—0**; most readers would consider the entry a misprint, but it is not. In whole degrees **0 F.** represents all readings between —17°·5 C. and —18°·1 C., but by adding or omitting the — sign, we can indicate from —17°·5 C. to —17°·8 C. by **+0**, and —17°·8 to —18°·1 by **—0**. It will further be noticed that two kinds of type are used in these tables, all readings below 32° being in heavy type.

We hope that the tables, including the little abstract one, are self-explanatory, except perhaps the fourth column of the last, which is based upon the three previous columns. It was obtained by giving rotation numbers to the entries in the previous columns, and then adding those for each station and placing the names in the order thus obtained—*e.g.*:

Average Min.	Absolute Min.	Nights below 32°.	Resultant order.
1 Algiers	1 Monaco	1 Lisbon	5 Lisbon
2 Lisbon	2 Lisbon	2 Monaco	6 Monaco
3 Monaco	3 Scilly	3 Algiers	9 Algiers
4 Scilly	4 Valencia	4 Valencia	14 Valencia
5 Rome	5 Algiers	5 Rome	15 Scilly

[*Cont. on p.* 4.

MINIMUM TEMPERATURES IN WESTERN EUROPE AND ALGERIA.

DATE.	SWEDEN.	SCOTLAND.	SCOTLAND.	SCOTLAND.	IRELAND.	IRELAND.	ENGLAND.	ENGLAND.	ENGLAND.	BELGIUM.	DATE.
	Stockholm.	Shetland, Sumburghead.	Lewis, Stornoway.	Leith.	Donegal, Malin Head.	Valencia.	York.	London.	Scilly.	Brussels.	
Dec. 13	18	41	37	27	36	40	30	24	39	19	13 Dec.
,, 14	23	37	39	23	35	45	20	18	38	17	14 ,,
,, 15	23	35	39	27	37	42	21	19	40	12	15 ,,
,, 16	28	38	36	36	38	35	28	24	40	9	16 ,,
, 17	18	36	27	34	32	33	32	26	34	11	17 ,,
,, 18	16	36	36	31	32	36	30	26	35	11	18 ,,
,, 19	16	34	33	25	33	39	26	27	42	12	19 ,,
,, 20	27	34	33	27	35	35	21	19	42	23	20 ,,
,, 21	21	32	29	24	34	33	15	23	39	29	21 ,,
,, 22	27	33	30	22	33	33	14	14	40	25	22 ,,
,, 23	23	40	42	30	37	43	16	15	44	24	23 ,,
,, 24	25	41	36	29	38	37	27	27	41	21	24 ,,
,, 25	25	43	41	27	35	37	27	22	39	19	25 ,,
,, 26	25	34	30	34	40	32	29	24	40	22	26 ,,
,, 27	27	35	31	35	36	32	31	30	39	21	27 ,,
,, 28	28	37	33	35	34	33	31	27	36	(16)	28 ,,
,, 29	14	37	31	30	35	32	31	29	36	8	29 ,,
,, 30	16	36	30	34	35	34	31	25	31	3	30 ,,
,, 31	12	35	33	36	36	31	29	20	30	7	31 ,,
Jan. 1	12	37	35	36	33	34	30	25	37	12	1 Jan.
,, 2	23	39	38	31	38	28	30	27	46	22	2 ,,
,, 3	19	37	39	34	35	29	28	27	46	20	3 ,,
,, 4	16	30	33	36	39	34	30	27	44	32	4 ,,
,, 5	19	28	30	31	35	35	30	30	39	30	5 ,,
,, 6	4	29	28	30	34	31	21	26	31	21	6 ,,
,, 7	3	35	26	27	31	29	18	25	30	18	7 ,,
,, 8	3	34	32	21	30	35	20	25	31	22	8 ,,
,, 9	10	38	34	30	34	40	24	25	39	13	9 ,,
,, 10	—0	38	34	25	33	33	28	15	40	16	10 ,,
,, 11	3	42	40	27	31	39	22	14	36	12	11 ,,
,, 12	3	45	48	42	41	41	25	18	38	17	12 ,,
,, 13	16	44	46	42	43	32	32	24	39	28	13 ,,
,, 14	14	33	34	37	40	33	33	34	42	31	14 ,,
,, 15	23	30	31	32	38	38	29	30	38	27	15 ,,
,, 16	14	33	37	34	41	38	30	31	39	22	16 ,,
,, 17	12	30	35	29	40	36	25	25	29	4	17 ,,
,, 18	7	31	37	22	30	36	10	22	29	5	18 ,,
,, 19	3	36	33	23	31	37	11	21	31	19	19 ,,
,, 20	10	39	33	33	28	40	17	23	32	11	20 ,,
,, 21	21	27	25	26	31	40	31	31	43	19	21 ,,
,, 22	23	28	25	28	37	41	30	29	42	21	22 ,,
Mean....	16·3	35·5	34·1	30·3	35·2	35·6	25·4	24·2	37·7	17·8	
Lowest..	0	27°	25°	21°	28°	28°	10°	14°	29°	3°	
Nights below 32°	41	8	13	25	7	5	38	40	8	40	

MINIMUM TEMPERATURES IN WESTERN EUROPE AND ALGERIA.

DATE.	GERMANY.	FRANCE.	GERMANY.	AUSTRIA.	FRANCE.	FRANCE.	MONACO.	ITALY.	PORTUGAL.	ALGERIA.	DATE.
	Berlin.	Paris.	Munich.	Vienna.	Biarritz.	Perpignan.	The Riviera, Monaco.	Rome.	Lisbon.	Algiers.	
Dec. 13	30	17	7	14	36	35	40	30	48	50	13 Dec.
,, 14	21	15	5	10	27	29	40	37	50	46	14 ,,
,, 15	10	8	5	12	32	30	39	32	50	48	15 ,,
,, 16	9	9	7	19	41	36	40	27	50	52	16 ,,
,, 17	(17)	20	(15)	21	45	29	40	41	48	52	17 ,,
,, 18	14	20	14	10	32	33	43	46	48	48	18 ,,
,, 19	7	22	7	10	41	28	40	36	50	46	19 ,,
,, 20	14	35	9	18	43	33	41	43	45	52	20 ,,
,, 21	30	28	9	14	30	32	41	41	46	48	21 ,,
,, 22	18	29	1	14	39	36	49	41	43	43	22 ,,
,, 23	25	25	3	25	32	41	47	45	46	45	23 ,,
,, 24	25	23	16	21	37	39	48	41	46	46	24 ,,
,, 25	23	20	19	25	28	25	45	36	37	48	25 ,,
,, 26	19	19	19	21	28	28	43	39	39	48	26 ,,
,, 27	14	24	19	18	27	26	43	39	37	48	27 ,,
,, 28	5	19	14	3	27	29	48	45	37	45	28 ,,
,, 29	5	19	—0	—2	34	31	48	41	45	48	29 ,,
,, 30	3	11	1	—2	36	34	41	32	48	48	30 ,,
,, 31	1	15	3	10	43	46	39	39	48	52	31 ,,
Jan. 1	7	29	3	1	43	50	48	39	48	52	1 Jan.
,, 2	14	21	3	1	46	50	51	37	50	52	2 ,,
,, 3	10	22	5	12	48	47	48	34	50	50	3 ,,
,, 4	12	33	18	9	45	43	48	34	43	50	4 ,,
,, 5	12	33	23	9	39	39	46	36	48	50	5 ,,
,, 6	19	21	16	16	28	36	44	41	48	52	6 ,,
,, 7	16	19	7	18	18	24	43	43	34	50	7 ,,
,, 8	14	17	9	18	21	25	42	46	34	39	8 ,,
,, 9	10	11	10	18	23	29	37	36	46	34	9 ,,
,, 10	14	15	10	18	14	29	37	36	43	39	10 ,,
,, 11	19	14	10	27	25	25	44	36	36	39	11 ,,
,, 12	23	17	12	18	25	25	45	34	37	43	12 ,,
,, 13	32	35	18	25	30	35	46	34	39	46	13 ,,
,, 14	34	28	21	21	30	34	45	34	39	43	14 ,,
,, 15	25	30	21	23	30	33	40	34	39	43	15 ,,
,, 16	12	25	9	19	27	28	31	32	37	39	16 ,,
,, 17	—0	10	—2	10	21	21	31	25	41	39	17 ,,
,, 18	—2	9	—0	7	10	17	33	32	39	34	18 ,,
,, 19	23	21	1	7	18	20	35	30	30	28	19 ,,
,, 20	16	8	3	14	23	25	39	23	32	30	20 ,,
,, 21	16	29	10	14	28	27	40	27	32	36	21 ,,
,, 22	25	27	12	12	45	41	39	36	48	48	22 ,,
Mean....	15·6	20·8	9·6	14·1	31·6	32·3	42·1	36·3	42·8	45·1	
Lowest..	—2°	8°	—2°	—2°	10°	16°	31°	23°	30°	28°	
Nights below 32°	39	37	41	41	21	21	2	6	1	2	

Average Minimum.		Absolute Minimum.		Nights below 32°		Resultant Order.
Algiers	45·1	Monaco	31	Lisbon	1	Lisbon.
Lisbon	42·8	Lisbon	30	Monaco	2	Monaco.
Monaco.....	42·1	Scilly Isles...	29	Algiers	2	Algiers.
Scilly Isles..	37·7	Valencia.....	28	Valencia.....	5	Valencia.
Rome..... ...	36·3	Algiers	28	Rome	6	Scilly.
Valencia ...	35·6	Donegal	28	Donegal	7	Rome.
Shetland ...	35·5	Shetland.. ...	27	Shetland.....	8	Donegal.
Donegal.....	35·2	Lewis	25	Scilly	8	Shetland.
Lewis.....	34·1	Rome	23	Lewis	13	Lewis.
Perpignan...	32·3	Leith	21	Perpignan ...	21	Perpignan.
Biarritz.....	31·6	Perpignan ...	17	Biarritz	21	Leith.
Leith.....	30·3	London	14	Leith	25	Biarritz.
York.....	25·4	York	10	Paris	37	York.
London.....	24·2	Biarritz	10	York	38	London.
Paris	20·8	Paris	8	Berlin.....	39	Paris.
Brussels ...	17·8	Brussels.....	3	London	40	Brussels.
Stockholm..	16·3	Stockholm...	0	Brussels.....	40	Stockholm.
Berlin	15·6	Berlin.....	—2	Stockholm ...	41	Berlin.
Vienna	14·1	Munich	—2	Munich	41	Munich.
Munich.....	9·6	Vienna	—2	Vienna	41	Vienna.

We had inserted in the general tables returns from Nice, but found that they were from M. Bischoffscheim's splendid observatory on Mont Gros, and on that lofty spot the temperature does not truly represent the city, and we have therefore struck them out and inserted those from Monaco. The results for Monaco and for Mont Gros are as follows :—

	Nice (Mont Gros).	Monaco.
Average Min.	34°·8	42°·1
Absolute Min.	25°	31°
Nights below 32°	8	2

Perhaps it would be fair to assume that the 25° on Mont Gros represented 28° in the town of Nice. We are not certain as to the best authority on the temperatures in Nice. Lee, in his "*Nice and its Climate*," gives (apparently on the authority of Roubadi) 27°·5 F. as the absolute lowest recorded up to the date of his book (1854). In Dr. West's translation of Dr. Baréty's "*Nice et son Climat*," we find the same value (27°·5 F.) given as the absolute minimum for January, and 37° F. for December, but he says that at sunrise on February 14th, 1854, the thermometer had fallen to 25°·9 F. It is, therefore, evident that the recent frost at Nice was unusual but not unprecedented.

Next let us take Perpignan. There, fortunately, the Observatory is in the town, and moreover the records extend far back, and have throughout been under the supervision of Dr. Fines. It will be seen* that these records have been continued for 43 years, and that once in January a temperature of 18°·5 was recorded; on January

* *Quar. Jour. Roy. Met. Soc.* xiii. p. 51.

18th, 1891, the temperature there fell to 16°·7 F., or 1°·8 lower than had ever been observed there.

We are not sure as to the quality of the observations from Biarritz, as we do not know whether they were sent by M. Sébie or from the Lighthouse—the latter would not accurately represent the climate of the town. Taking them, however, *quant. val.*, we have a minimum of 10° F., *i.e.*, 4° colder than London.

We have lately been reading Cotte's *Mémoires sur la Météorologie*, and have been much struck by his remarks upon the great improvement in, and development of, meteorological observations which resulted from the excessive frost of 1776. The Royal Society of London, the Académie des Sciences of Paris, in fact nearly all the learned bodies, were roused, and thermometry received a great impulse. So may it be with the frost of 1891. At our regular observing stations there is not much improvement needed. But thermometers have become too common and too low priced, it is too bad that persons should rush into print with records from thermometers bought as our correspondent Mr. Wright truthfully described in our last, and mounted—anyhow.

PHENOLOGICAL OBSERVATIONS.

To the Editor of the Meteorological Magazine.

SIR,—The observations of the first flowering of plants and the first appearance of birds and insects required by the Royal Meteorological Society have been now rendered so simple, that I hope all those of your readers who have been in the habit of making similar notes for "British Rainfall," may be induced to join the Society's staff of Phenological observers. It is not necessary that observers should be Fellows of the Royal Meteorological Society.

The number of plants to be noticed, has this year been reduced to thirteen, the number of birds to six, and the number of insects to five. The trees, shrubs and plants are such familiar ones as the horse-chestnut, hawthorn and coltsfoot. Of the six birds may be mentioned as equally well-known, the swallow, the cuckoo, and the nightingale; while the five insects are the honey bee, wasp and small white, orange tip, and meadow brown, butterflies. Observers may elect to observe either plants, birds or insects, or all three as they may feel disposed.

I need only add that I shall be very pleased to supply intending observers with forms, and to give any help or further information they require.

EDWARD MAWLEY,
Phenological Recorder to the Royal Meteorological Soc.

Rosebank, Berkhamsted, Herts.

REVIEW.

Results of the Magnetical and Meteorological Observations, made at the Royal Observatory, Greenwich, in the year 1888, *under the direction of* W. H. M. CHRISTIE, M.A., F.R.S., Astronomer Royal, London, 1890, 4to. lvii. + xci. pages and 11 plates.

IT is obviously impossible for us to notice all the issues of serial publications, although it would be well so to do; we should have no room for anything else. The Greenwich volumes have a reputation which needs no addition from us. We certainly do not understand why they are so far behind date, that they cannot be brought up closer without a temporary strengthening of the staff is very likely. Years ago delay occurred, and that it is only by the above method that the arrears can be overtaken is quite probable; but we think that such a temporary effort should be made, and that the observations of 1889 ought to be issued before February, 1892.

The Greenwich authorities, unlike those of one of our other important observatories, are fully aware of the importance of continuity in meteorological work, and they adhere to the old "Glaisher's stand" which, by-the-bye, according to the volume before us, ought to be called "Airy's stand." "The . . . . thermometers . . . . are mounted on a revolving frame, planned by Sir G. B. Airy." Be that, however, as it may, in 1887 a Stevenson screen was erected 11 feet E. of the old one, and the results as given by it for 1888 are printed *in extenso* in the present volume; and also the differences between the old stand and the Stevenson. The result for the year abstracted, yields the following valnes:—

	Old Stand above Stevenson	Old Stand below Stevenson.	Old Stand above Stevenson.	Old Stand below Stevenson.	Corrected mean of M. & m. on Glaisher.	Arithmetical mean of M.&m. on Stevenson.	Arithmetical mean of 9 & 9 on Stevenson.
	Max.	Min.	9 a.m.	9 p.m.			
	deg.	deg.	deg.	deg.	deg.	deg.	deg.
January	0·3	0·3	0·0	0·0	37·5	37·7	37·2
February.....	0·4	0·3	0·2	0·0	34·9	35·2	34·7
March	1 0	0·2	0·2	0·2	37·9	38·6	37·8
April	1·7	0·3	0·2	0·1	43·3	44·1	43·0
May	1·8	0·5	0·3	0·2	52·2	53·2	52·5
June.....	2·2	0·3	0·4	0·1	57·6	58·4	57·3
July	2·0	0·4	0·2	0·1	57·6	58·7	57·9
August	1·8	0·4	0·1	0·2	58·7	59·8	59·0
September ...	1·1	0·6	0·0	0·1	56·1	57·1	55·7
October	0·8	0·5	0·1	0·2	45·6	46·4	45·3
November ...	0·5	0·3	0·0	0·1	46·6	46·9	46·3
December ...	0·3	0·3	0·1	0·1	40·8	40·8	40·1
Year.....	1·2	0·4	0·2	0·1	47·4	48·1	47·2

The serious part is, of course, the first column, which shows that the maxima on the old stand are on the average of the whole year 1°·2 above those in the Stevenson, and on looking into the details we find that this excess reached or exceeded 3° on nine occasions, and on one hot day with bright sun, reached 4°·4; thus confirming remarks previously made that the maxima reported for Greenwich on very hot days are exceptionally high. There is one rather curious fact with reference to these Maxima: Many years ago, Mr. Glaisher published a pamphlet, "Diurnal Range Tables," 4th edition, 1867, in which he gives "corrections to be applied subtractively to the simple arithmetical monthly mean of the readings of the maximum and minimum thermometers, to deduce from them the mean temperature of the air for the month." These corrections were based upon, and intended for use with, the Glaisher (or Airy) stand. Moreover, the Royal Meteorological Society has always held that the mean of the maximum and of the minimum in a Stevenson was very near the truth. In the later columns of the above table we give (1) the mean of the maximum and minimum on the old stand, corrected by Glaisher's table; (2) the mean of the maximum and minimum in the Stevenson, uncorrected; (3) the mean of the 9 a.m. and 9 p.m. in Stevenson, uncorrected.

As 1888 was rather a cold year, these results do not work out quite as accordantly as they would in an average year, that is to say the Glaisher corrections are rather too large, and they have the curious result of making the Greenwich stand *seem* to give too low a temperature. This correction, to the mean of the maximum and minimum, is doubtless really one for the excess of the maximum, and therefore in a cold year should be less than its average value, which is —1°·1. Suppose that the correction should in such a year be —0°·7, we should then have

Mean of M. and m. on Glaisher stand	48·5 —0·7	= 47·8.
,, ,, Stevenson ,,	48·1	= 48·1.
,, Hourly photographic record		= 47·8.
,, 9 a.m. & 9 p.m.		= 47·2.

All, except the last, agreeing very closely.

While greatly admiring the persistency with which the Greenwich authorities adhere to their old systems, such as retaining the unique practice of dividing their days at midnight, we think that they might make one concession which would render their records comparable with the multitude of other stations throughout the country, viz., work their Stevenson stand *daily* throughout the year, and absolutely in accordance with the rules of the Royal Meteorological Society. The extra time required on Sundays would not be five minutes, and the noon and 3 p.m. observations daily throughout the year have now probably gone on long enough, and their abandonment would far outbalance the extra labour we suggest.

FROST PENETRATION.

To the Editor of the Meteorological Magazine.

SIR,—It would, I think, be interesting and instructive if some of your observers would furnish information as to how far the late long-continued frosts reached into the ground. I have tried in several parts of my garden and have not found the depth to which the frost penetrated to exceed 12 inches, and in most places not to have gone so far. Four of the holes which I had opened were in vegetable or flower borders, and one, which I had opened this morning, was under turf. I am told, however, by a builder here, on whom I think I can rely, that the water in a pipe was frozen solid, though covered by 18 inches of soil in the roadway; and I have been informed by a nurseryman here, and by more than one labourer, that the frost has gone down 22 and even 24 inches, and that, not in wet soil.

I imagined that this severe winter would have destroyed a great number of our garden pests, but a day or two ago, I found several slugs as happy as ever at the stem of a Christmas rose, where some dead leaves lay two or three thick, and my gardener tells me he found a caterpillar on the top of a plant of Brussels sprouts, which was quite lively when he took it in his hand and just breathed on it.

—Yours truly, JAMES WESTON.

1, *Camden Park, Tunbridge Wells,*
30th January, 1891.

[We are sure that Mr. Mawley, of Berkhamstead, will not mind our quoting, for general information, a few lines which we recently received from him on the above subject:—

"Our supply of water from the town was cut off for a week, and yet the ground, owing to its dryness, was never frozen more than 8 inches deep. Temp. of ground at 1 foot, a degree below freezing, yet, on taking up the ground on the same grass plat, the soil was frozen barely 7 inches deep."

Perhaps we may be allowed to add a few words on this subject, which, as regards water-supply and some other matters, is one involving thousands of pounds. With reference to the above letters, we should be glad to know in what way frozen dry soil differs from unfrozen. Dry sand at 50° below freezing would surely be just as mobile as at 50° above it. No observatory has such good instruments in such perfect order as Mr. Mawley has; how then could his thermometer at 1 foot show 31° if the ground around it was not frozen? Our impression is that both at Tunbridge Wells and at Berkhamstead the ground was frozen, but that there was not ice enough in it to make it hard. But we are quite ready to be converted.

The readings of the 1-foot thermometer in three frosts at Camden Square may be of interest:—

In January, 1880, there were 19 consecutive days with no rain or snow, except a sprinkle of 0·01 in. of snow, which soon dried up.

The max. was generally about 35°, and the min. about 25°; the 1-ft. ther. fell steadily, and on the 13th day reached 32°; on the next day, and all the subsequent six days (but one), the max. was between 40° and 50°, the min. about 28°, and the mean about 36°, but the 1-ft. thermometer remained at 32° until rain came, when it at once rose.

In January, 1881, we had three cold weeks, one of them far colder than any week either in 1880 or in 1891, the min. in one week averaging 15°·9; and yet the 1-ft. thermometer never went below 33°·1, and was there only two days—*but* there were 10 inches of snow on the ground.

In December, 1890, and January, 1891, we have had several cold weeks, colder than any in 1880, and yet the 1-ft. thermometer has never been below 32°·7, and only there two days, but, though there has been nothing like the snow of 1881, the ground was generally covered.—ED.]

GRASS THERMOMETERS IN TIME OF SNOW.

To the Editor of the Meteorological Magazine.

SIR,—On page 187 of the last number of the *Meteorological Magazine*, it is stated in the course of an interesting note by the observer at Strathfield Turgiss, that "on the 22nd [of December, 1890] the minimum in the Stevenson stand dropped to 7°·5 and on the grass (the snow having been swept away) fell to 4°·5 (both thermometers being in exact working order, and Kew corrections applied)."

From the above it seems clear that the practice at Strathfield Turgiss when snow is lying upon the ground, is to sweep the same away from the grass upon which the terrestrial radiation thermometer is placed. May not exception be taken to this? In Scott's "Instructions" we read, "whenever snow is lying, the radiation thermometer should be placed on its surface"; and on page 14 of Marriott's "Hints" occurs the following sentence: "When the ground is covered with snow the thermometer should be placed on the surface of the snow."

The difference between the heat-conducting and radiating powers of snow, and those of short grass, are too considerable to be ignored; and when a part of the earth's surface is covered with snow, any observations of the extent of terrestrial radiation made upon grass from which the snow has been swept away, however interesting they may be as showing what might have occurred had no snow been lying, will certainly represent a state of things which, at that time, is non-existent in nature—at least in that particular locality. The larger the area that is freed from snow, the greater the error. The difference between the results obtained by the two methods will doubtless be far greater than the "Kew corrections," which the Strathfield Turgiss observer seems careful to apply. It might be well to remember that the lowest temperature in a whole winter

(an important point to record correctly) not infrequently occurs at some stations when the ground is covered with snow.

Another class of discordances may probably now and then be occasioned (especially in changeable weather when the sky clears for short periods) by the employment of a highly sensitive minimum thermometer (*e.g.* Hicks' "Cylinder Jacket") at one station, and the old Spherical bulb at another. Yours faithfully,

JOSEPH BAXENDELL.

The Observatory, Birkdale, Southport.

ROYAL METEOROLOGICAL SOCIETY.

The annual meeting of this Society was held on Wednesday, January 21st at the Institution of Civil Engineers, 25, Great George-street, Westminster. Mr. W. H. Dines, B.A., Vice-President, in the chair.

Dr. Tripe read the report of the Council, which stated that the progress of the Society during the past year had been satisfactory. Among the investigations carried on by the Society are the following :—The organization of a large number of meteorological stations, the observations from which are examined and reduced by the staff, and printed in the "Meteorological Record"; the regular inspection of these stations by the Assistant Secretary; the collection and discussion of Phenological Observations, and an inquiry into the Thunderstorms of 1888 and 1889. An Exhibition of Instruments is held annually in March. During the year, a complete catalogue of the Library, extending to 222 pages has been compiled and published. The Library has so much over-grown the present limited accommodation, that the Council have been obliged to consider the question of obtaining more commodious rooms, and have consequently inaugurated a "New Premises Fund," which is being well supported by the Fellows.

After the adoption of the Report, the Officers and Council for the ensuing year were elected.

At the ordinary meeting the following papers were read :—

1. "Note on a peculiar development of Cirrus Cloud observed in Southern Switzerland"; by Mr. R. H. Scott, M.A., F.R.S.

2. "Some remarks on Dew"; by Col. W. F. Badgley, F.R.Met. Soc. These are notes on observations, which were made to discover, whether all dew is deposited from the air, or if some also comes from the earth and plants, and also what quantity is formed during the year. The conclusions which the author deduces from his observations are :—(1.) That the earth always exhales water vapour by night, and probably a greater quantity by day; (2.) That the quantity of water vapour given off by the earth is always considerable, and that any variation in the quantity is mainly due to the season of the year; (3.) That the greater part of the dew comes from the earth vapour; and (4.) That plants exhale water vapour, and do not exude moisture. The total quantity of dew collected on the author's plates in the year, was 1·61 ins.

ORIGIN OF A WHIRLWIND.

[Although very much after date, we think that the following report ought not to be excluded.—ED.]

A strange ærial phenomenon was recently observed at Neu-Münster, in Holstein. At a considerable height, a current of air was moving with tremendous velocity from east to west. Somewhat lower there was an opposite and much slower current. After this had continued for some time, the two currents suddenly developed into a whirlwind, which did immense damage, raising from the ground and destroying a large barn, and tearing great trees out of the earth as if they were only so many straws.

The Standard, July 17th, 1890.

BRIGHT METEOR, DECEMBER 14TH, 1890.

To the Editor of the Meteorological Magazine.

SIR,—As the *Meteorological Magizine* usually takes notes of meteors of exceptional brilliancy, I was somewhat disappointed to find no mention in your January number of that which was seen about 9.40 p.m. or 9.45 p.m. on Sunday, December 14th. I was not fortunate enough to see it myself, but from the accounts of those who were, it must have been one of great magnitude. The only reference to it, which I saw in the daily papers, was a short paragraph in the *Times*, stating that a large meteor had been seen that evening at Ramsgate. Possibly the publication of this might bring you information about it from some of your numerous observers.—Yours faithfully,

J. W. SCOTT.

Elleray, Etchingham Park, Finchley, N., Feb. 4th, 1891.

[Yes, Mr. Scott is quite right. Unfortunately the editorial "we" has far too much to do, and far too little help, and unless by some miracle the circulation of the *Met. Mag.* is increased 100-fold or 1,000-fold, so as, for instance, to bring it to that of the *Leisure Hour* or a "penny dreadful," we do not see much prospect of improving matters.—The meteor was a remarkably fine one, the light being greater than that usually received from a full moon ; it was seen as far north as Bury St. Edmunds, as far west as Middlesex, and as far east as Ramsgate. We can find very little information as to its path, which was apparently from N. to S., and possibly not far from the meridian of Greenwich. Most persons who saw it appear to have either been ignorant of what to observe, or to have been too much astonished to give proper details of what they saw. Nearly all seem to have had the idea that it fell within a mile or so of them. That this was not the case, is sufficiently proved by the distance between, *e.g.*, Sittingbourne and Bury St. Edmunds (70 miles), or Finchley and Ramsgate (60 miles), it could not have been close to all of them, and also by the fact that no one reported any sound.—ED.]

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JULY, 1890.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	76·2	23*a*	42·4	12	69·3	52·6	51·1	74	126·9	40·6	4·20	14	6·4
Malta	92·2	18	62·7	25	85·3	68·8	64·0	67	145·9	57·0	...	...	0·6
Cape of Good Hope	71·0	11	31·6	18	59·6	44·7	...	...	...	...	6·39	...	6·2
Mauritius	75·0	2	53·5	26	72·8	61·7	58·4	75	123·2	47·4	4·30	21	4·7
Calcutta	90·1	18	75·2	28	87·0	77·0	78·1	86	156·9	73·9	10·29	24	7·9
Bombay	85·6	8	74·5	16*b*	83·3	76·2	75·5	86	134·0	72·4	21·54	31	9·5
Ceylon, Colombo	86·7	...	72·0	29	84·5	74·2	71·6	80	147·0	69·0	3·32	12	5·5
Melbourne	62·4	18	29 0	16	54·7	40·1	41·8	82	112·0	23·6	2·71	13	6·5
Adelaide	60·3	18	34·2	17	57·1	43·3	42·8	79	134·5	25·0	5·36	20	5·9
Wellington	58·0	10	33·0	18	52·7	42·6	42·4	83	101·0	28·0	8·95	25	5·5
Auckland	64·0	11	42·0	18*c*	58·8	49·0	47·0	78	115·0	32·0	5·19	28	7·6
Jamaica, Kingston	94·4	21	68·6	1	89·5	72·3	70·4	69	...	...	·34	...	...
Trinidad	95·0	16	61·0	2	86·3	68·6	71·1	80	154·0	60·5	12·89	18	...
Toronto	85·3	31	47·2	21	77 1	58·0	59·4	74	...	40·2	4·11	11	4·0
New Brunswick, Fredericton	86·0	29	42·0	19	76·8	54·3	58·8	72	...	...	2·44	13	5·0
Manitoba, Winnipeg	90·1	27	42·3	9	80·1	54·6	57·2	73	...	...	5·58	13	3·0
British Columbia, Victoria	...	...	...	...	...	...	...	...	...	...	...	...	...

a And 24. *b* And 17. *c* And 21.

REMARKS.

MALTA.—Mean temp. 75°·8; mean hourly velocity of wind, 8·5 miles; sea temp. rose from 76°·5 to 80°·0; L on 12th. J. SCOLES.

Mauritius.—Mean temp of air, 1°·7 below, mean dew point 0°·9 below, and R 2·00 in above their respective averages; mean hourly velocity of wind, 10·0 miles, or 2·0 below average; extremes 24·1 on 13th and 2·4 on 26th; prevailing direction, S.E. by E. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air, 0°·6 below average. Mean temp. of dew point 0°·4, humidity 2, amount of cloud 0·2, and R ·99 in. above their respective averages. Prevailing winds N. and N.E., strong on 6 days; heavy dews on 8 days; dense fog on 8 days; hoarfrost on 3 days; L on 13th. R. L. J. ELLERY, F.R.S.

Adelaide.—Although there was little frost the month was cold, the mean temp. being 1°·5 below the average of 33 years. The mean pressure was 0·069 in. below the average, and the extreme range was greater than usual. The month was very wet, the total being 2·82 in. above the average, and it was the wettest July on record, with the exception of 1865, when, however, only ·017 in. more was registered. C. TODD, F.R.S.

Wellington.—Wet weather almost throughout the R being 2·85 in. above the average; fog on 3 days; L on 9th and 10th; prevailing wind S.E.; temperature exactly the average. R. B. GORE.

Auckland.—A showery, stormy, and disagreeable month; rain being recorded on every day but three. Mean temp. 1° above the average,; R ·50 in. above the average. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL, JANUARY, 1891.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in			in.
II.	Dorking, Abinger Hall.	2·72	XI.	Llanwrtyd Wells	4·52
,,	Margate, Birchington...	1.60	,,	Rhayader, Nantgwillt..	6·45
,,	Brighton,PrestonvilleRd	2·29	,,	Corwen, Rhug	1·63
,,	Hailsham	3·25	,,	Carnarvon, Cocksidia ...	2·85
,,	Ryde, Thornbrough	3·21	,,	I. of Man, Douglas	1·90
,,	Alton, Ashdell.....	3·54	XII.	Stoneykirk,ArdwellHo.	1·73
III.	Oxford, Magdalen Col...	1·40	,,	New Galloway, Glenlee	5·50
,,	Banbury, Bloxham	2·00	,,	Melrose, Abbey Gate ...	1·99
,,	Northampton	1·67	XIII.	N. Esk Res. [Penicuick]	2·10
,,	Cambridge, Fulbourne..	2·80	XIV.	Ballantrae, Glendrishaig	2·33
,,	Wisbech, Bank House..	1·73	,,	Glasgow, Queen's Park.	3·87
IV.	Southend	·83	XV.	Islay, Gruinart School..	4·31
,,	Harlow, Sheering	1·62	XVI.	Dollar.....	2·27
,,	Rendlesham Hall	2·31	,,	Balquhidder, Stronvar..	6·64
,,	Diss	2·25	,,	Coupar Angus Station..	1·17
,,	Swaffham	2·42	,,	Dunkeld, Inver Braan..	2·39
V.	Salisbury, Alderbury ...	2·35	,,	Dalnaspidal H.R.S. ...	6·48
,,	Warminster	2·25	XVII.	Keith H.R.S.	1·57
,,	Bishop's Cannings	2·00	,,	Forres H.R.S.	1·61
,,	Ashburton, Holne Vic....	7·43	XVIII.	Fearn, Lower Pitkerrie.	1·35
,,	Okehampton, Oaklands.	4·45	,,	Loch Shiel, Glenaladale	...
,,	Lynmouth, Glenthorne.	5·14	,,	N. Uist. Loch Maddy ...	5·66
,,	Probus, Lamellyn	3·48	,,	Invergarry	8·24
,,	Launceston, S. Petherwin	...	,,	Aviemore H.R.S.	2·12
,,	Wincanton,StowellRec.	2·23	,,	Loch Ness, Drumnadrochit	3·21
,,	Wells, Westbury.....	2·51	XIX.	Lairg H.R.S.	...
VI.	Bristol, Clifton	3·83	,,	Scourie	4·76
,,	Ross, the Graig	1·91	,,	Watten H.R.S.	·87
,,	Wem, Clive Vicarage ...	1·61	XX.	Dunmanway,Coolkelure	3·96
,,	Cheadle, The Heath Ho.	2·26	,,	Fermoy, Gas Works ...	...
,,	Worcester, Diglis Lock	1·72	,,	Darrynane Abbey.....	3·37
,,	Coventry, Coundon	2·53	,,	Tipperary, Henry Street	2·59
VII.	Ketton Hall [Stamford]	1·42	,,	Limerick, Kilcornan ...	2·00
,,	Grantham, Stainby	1·52	,,	Ennis..... .	2·52
,,	Horncastle, Bucknall ...	1·62	,,	Miltown Malbay.....	1·94
,,	Worksop,HodsockPriory	1·30	XXI.	Gorey, Courtown House	1·54
VIII.	Neston, Hinderton	1·21	,,	Mullingar, Belvedere ...	1·16
,,	Knutsford, Heathside ...	2·02	,,	Athlone, Twyford	1·58
,,	Lancaster, Southfield ...	2·19	,,	Longford, Currygrane...	1·52
,,	Broughton-in-Furness ..	3·27	XXII.	Galway, Queen's Coll...	2·21
IX.	Ripon, Mickley	2·00	,,	Crossmolina, Enniscoe..	3·56
,,	Scarborough,WestBank	1·03	,,	Collooney, Markree Obs.	2·83
,,	EastLayton[Darlington]	1·01	,,	Ballinamore, Lawderdale	1·93
,,	Middleton, Mickleton ..	2·29	,,	Lough Sheelin, Arley ..	1·53
X.	Haltwhistle, Unthank..	1·77	XXIII.	Warrenpoint	1·23
,,	Bamburgh.....	·86	,,	Seaforde	1·17
,,	Shap, Copy Hill	6·50	,,	Belfast, New Barnsley..	...
XI.	Llanfrechfa Grange	4·14	,,	Bushmills, Dundarave...	2·24
,,	Llandovery	5·22	,,	Stewartstown	1·85
,,	Castle Malgwyn	...	,,	Buncrana	3·08

JANUARY, 1891.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average. 1880-9.	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date	Min. Deg.	Min. Date	No. of Nights below 32°. In shade.	No. of Nights below 32°. On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·80	+ ·18	·35	23	14	53·0	31	16·9	11	22	25
II.		Maidstone (Hunton Court)...	1·56	+ ·01	·37	29	10	...	...	...	...	...	...
,,		Strathfield Turgiss	1·73	— ·08	·32	29	14	52·2	31	11·2	19	22	27
III.		Hitchin	1·59	+ ·05	·25	20	15	50·0	31	12·0	10*e*	23	...
,,		Winslow (Addington)	2·03	+ ·22	·48	23	14	51·0	28	8·0	11*f*	22	26
IV.		Bury St. Edmunds (Westley)	2·22	+ ·75	·32	23	13	...	...	...	...	...	...
,,		Norwich (Cossey)	2·04	+ ·55	·32	15	18	31·0	18	7·0	10	12	27
V.		Weymouth(LangtonHerring)	2·50	+ ·16	·52	29	15	49·0	28	17·0	19	15	...
,,		Barnstaple	2·67	— ·35	·62	23	12	58·0	25	16·0	19	...	...
,,		Bodmin (Fore Street)	4·42	+ ·41	·91	31	18	...	...	...	...	...	...
VI.		Stroud (Upfield)	2·62	+ ·42	·75	23	12	53·0	28	14·0	18	23	...
,,		ChurchStretton(Woolstaston)	3·14	+ ·98	·90	31	17	48·0	23*b*	15·0	18	18	25
,,		Tenbury (Orleton)	1·99	— ·15	·30	20	14	51·8	27	6·0	19	20	23
VII.		Leicester (Barkby)	1·69	— ·07	·50	31	14	52·0	28	3·0	18	22	27
,,		Boston	1·10	— ·29	·35	20	9	50·0	27	10·0	19	26	...
,,		Hesley Hall [Tickhill].....	1·10	— ·67	·28	20	13	50·0	29	9·0	19	23	...
VIII.		Manchester(PlymouthGrove)	2·38	— ·08	·70	20	12	51·0	29*c*	16·0	17*g*	18	25
IX.		Wetherby (Ribston Hall) ..	1·09	— ·80	·26	25	9	...	...	...	...	...	...
,,		Skipton (Arncliffe)	...	...	...	...	..	...	...	...	...	...	...
,,		Hull (PearsonPark)	1·30	— ·47	·20	24	20	...	...	...	...	..	...
X.		Newcastle (Town Moor)	1·10	— ·71	·30	15	14	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	11·34	— ·84	2·20	26	20	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	3·91	+ ·62	1·17	23	15	..	...	...	...	...	...
,,		Haverfordwest	4·41	— ·01	·77	8	19	49·9	11	14·5	5	17	25
,,		Carno (Tybrith)	4·71	+ ·46	1·10	20	19	43·0	23	8·0	17	26	...
,,		Llandudno.....	1·64	— ·64	·51	24	13	53·0	26	20·0	18	7	...
XII.	SCOTLAND.	Cargen [Dumfries]	3·38	— ·39	·81	20	14	49·0	12	17·0	8, 18	17	...
,,		Jedburgh (Sunnyside).....	1·17	— ·55	·32	23	9	49·0	12	10·0	18	18	...
XIV.		Old Cumnock	2·99	— 1·00	·68	20	14	50·0	28	12·0	17	22	...
XV.		Lochgilphead (Kilmory).....	5·58	— ·56	·92	22	23	...	...	20·0	4, 5	16	...
,,		Oban (Craigvarren)	4·83	...	1·04	20	21	50·0	28	25·9	6	9	...
,,		Mull (Quinish).....	5·84	+ ·17	·68	19	22	...	...	...	...	...	...
XVI.		Loch Leven Sluices	2·70	— ·20	·80	31	11	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	·75	— 1·22	·15	20*a*	10	50·2	12	19·4	8	18	...
XVII.		Braemar	2·13	— ·56	·42	20	16	49·8	12	8·0	7	22	26
,,		Aberdeen (Cranford)	1·02	...	·15	29	21	55·0	12	17·0	6	19	...
XVIII		Strome Ferry.....	5·66	— ·33	·96	19	24	...	..	...	...	...	..
,,		Inverness (Culloden)	1·31	— ·31	...	...	...	51·0	12*i*	23·0	23	16	28
XIX.		Dunrobin	2·11	— ·35	·69	24	15	53·0	12	23·0	7	21	...
,,		S. Ronaldsay (Roeberry).....	2·05	— ·90	·35	11	23	51·0	11	28·0	20*h*	...	13
XX.	IRELAND.	Dromore Castle	4·59	— 1·48	1·04	22	14	51·0	14	24·0	6	...	...
,,		Waterford (Brook Lodge) ...	1·87	— 1·69	·30	7	17	52·0	28	17·0	7	14	..
,,		O'Briensbridge (Ross)	2·39	...	·58	20	16	52·0	25	25·0	7	12	...
XXI.		Carlow (Browne's Hill)	1·66	— 1·24	·40	20	20	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	·67	— 1·19	·18	20	14	53·7	26*d*	23·9	7	7	21
XXII.		Ballinasloe	1·85	— 1·23	·25	7	20	47·0	26	14·0	7	26	...
,,		Clifden (Kylemore)	6·55	...	1·48	7	20	..	...	...	...	...	...
XXIII		Waringstown	1·47	— 1·18	·20	20	18	53·0	26*d*	17·0	6, 7	15	21
,,		Londonderry (Creggan Res.).	2·99	— ·43	·65	21	23	...	...	...	...	..	...
,,		Omagh (Edenfel).....	2·00	— 1·02	·33	21	26	50·0	30	20·0	6	15	18

a And 22. *b* And 28, 29. *c* And 30. *d* And 28. *e* And 17. *f* And 19. *g* And 18. *h* And 21, 22. *i* And 13.

+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON JANUARY, 1891.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The first three weeks of the new year brought continued severe weather, and until the 23rd no great change took place. On the 2nd, 6th, 7th, 10th, 11th, 17th and 18th, the maximum was below freezing point. From the 22nd to the close of the month there was more or less R every day, with a more genial temperature. Grass min. on 19th, 6°·3.

ADDINGTON.—Frost occurred on every night except one from the 1st to the 23rd, and was often very severe. On the 23rd a great increase in the temp. took place, and put an end to the very long period of frosty weather. The melting of the snow caused a very large flood, and great blocks of ice were carried out on to the meadows and in quantities never before observed.

BURY ST. EDMUNDS, WESTLEY.—The first twenty-three days of the month were very cold, the min. in the shade being below 32° every day except the 13th. The greatest cold was on the night of the 17th, when Casella's Kew verified thermometer, exposed 1 ft. above ground, registered —0°·5. Swedes and turnips were much damaged, but owing to absence of wind tender shrubs received very little injury.

LANGTON HERRING.—The early part of the month was fine, dry and very cold. From Nov. 25th, 1890, to Jan. 22nd, 1891, inclusive, the temp. was below the average, with the single exception of Dec. 1st, but for fifty-two consecutive days—Dec. 2nd to Jan. 22nd—it was below the average. On the 18th the temp. on the grass fell to 10°, and on the 19th to 11°. At sunset on the 19th the max. for the day was 31°, but the temp. rose in the evening to 35°. Bar. very high from 10th to 15th. Mean temp. at 9 a.m. 5°·0, and mean of max. and min. 4°·6 below the average.

BODMIN, FORE STREET.—A month of unprecedented severity, frost lasting without break from the 4th to the 20th, with very cold wind, generally N.E. or E. The coldest January recorded for many years. R every day from the 19th to to the 31st. Very heavy R and high winds on the 30th and 31st after 10 p.m.

STROUD, UPFIELD.—The thermometer was below freezing point for 22 days in succession.

WOOLSTASTON.—The long and severe frost continued, with occasional slight intervals of thaw, till the 23rd, when a real thaw set in. S fell on the 4th, 8th, and 16th. Mean temp. 34°·8.

ORLETON.—The first 19 days were intensely cold, the 9 a.m. reading averaging 26°·5, or nearly 11 degrees below the average for the month. The remainder of the month was very warm and pleasant, the mean for the whole being 4°·7 below the average. Nearly all the R fell after the 19th. S on the 8th, 16th, and 17th.

LEICESTER, BARKBY.—Forty-eight consecutive days of frost, from Dec. 6th, 1890, to Jan. 22nd, 1891, inclusive. Mean temp. for the month, 31°·7.

MANCHESTER, PLYMOUTH GROVE.—The month commenced with a gentle thaw and milder weather, but from 11th to 19th it was very wintry. On the 20th a complete thaw set in, with heavy R. The last week fine spring-like weather. Fog on 2nd, 3rd, 4th, 7th and 12th, and dense on 13th. S on 8th, 16th, 19th and 21st. Mean temp. 35°·4.

HULL, PEARSON PARK.—From the 1st to the 25th the weather was frosty, with slight falls of H and S, E. or N.E. winds prevailing. From the 25th to the end of the month it was mild with slight showers of R, and S. or S.W. winds. Generally overcast or very cloudy during the mornings, and either clear or with a small amount of light cloud during the afternoon and evening, throughout the month.

WALES.

HAVERFORDWEST.—The weather, already severe, became more so during this month, and it was the coldest since January, 1881, but far below that in severity. From the 20th to the end, the weather was wet, and sometimes stormy and mild. Skating was enjoyed for about a fortnight, the ice reaching a thickness of four inches.

SCOTLAND.

CARGEN.—During the month several sharp frosts took place, interspersed with a day or two of mild weather. The changes in temp. were very marked —*e.g.*, on the 8th the mean temp. for the 24 hours was 25°·9, while on the 11th it was 45°·2 The last six days were unusually mild for January, the mean temp. being 42°·6. On the 20th S fell to the depth of 4½ inches, with the exception of a few trifling showers, the only S that has fallen this winter. A severe gale, which lasting only a few hours, occurred on the morning of the 31st ; trees were blown down and other damage was done. On the 14th the sea level pressure was 30·810 in., which, with the exception of March, 1874, and January, 1882, is the highest recorded here for thirty-one years.

JEDBURGH.—The weather was cold and ungenial, with much frost. and the root crops were much injured. S fell on 4 days.

OBAN.—The month was comparatively dry, and the temperature low. There was an absence of severe gales, and growth did not cease in favoured parts. Some S fell on the 18th, 19th, and 20th. Close of the month rainy.

IRELAND.

DROMORE.—The early part of the month was dry and frosty.

WATERFORD, BROOK LODGE.—Mean temp. 39°·3.

O'BRIENSBRIDGE, ROSS.—Some S fell on different occasions up to the 20th, but to no considerable extent. Sharp frosts occurred every night from 5th to 16th, but a rise of temp. took place after the 20th, and on 27th the min. in shade was 45°. No snowdrops or crocuses.

DUBLIN.—The period of cold, which was ushered in by the phenomenal snow storm of November 27th, 1890, lasted with slight and temporary intermissions until the 23rd of January, when the south-westerly type of weather became permanently established over Western Europe, strong S. to W. winds, high variable temp., and frequent showers prevailing day after day to the end of the month. Mean temp. (40°·1) 1°·3 below the average. Solar halos on 18th and 31st ; fogs on 8 days ; high winds on 13 days, gales on 20th and 31st ; H on 17th and 24th ; and S or sleet on 19th and 21st. Temp. exceeded 50°·0 in the screen on only 5 days compared with 17 days in January, 1890.

BALLINASLOE.—A fine month generally, but very cold to the 18th. Barometer unusually high ; 30·77 in. on 14th (reduced to sea level).

EDENFEL.—A dull, fine month, with a preponderance of polar and easterly winds, light frosty nights, and thawing days. The last week unsettled. Extraordinary high bar. up to the 20th.

EARLY METEOROLOGY.

DR. HELLMANN and others will be glad to hear that Walter Merle's MS. has been found, and that efforts are being made to reproduce it with a translation.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CCCII.] MARCH, 1891. [PRICE FOURPENCE, *or 5s. per ann. post free.*

FEBRUARY, 1891.

THE rainfall of February was so abnormally small that the usual tables give quite inadequate details; we have therefore prepared a map showing the distribution over the British Isles, and devote almost the whole of the present number to its description and to notes with which we have been favoured by our correspondents.

The map is self-explanatory, but a few words may be devoted to its chief features. Over practically the whole of England and Wales the total rainfall of the month was less than half an inch, the only exceptions being on the mountains of Wales and in the Lake District, where such a small fall is probably physically impossible. The whole of the country, east of a line drawn from Sunderland to Plymouth, with three unimportant exceptions, had less than one-tenth of an inch of rain, snow, hail, dew, fog, and mist; while no fewer than 35 stations report absolutely no measurable quantity. The exceptions referred to are a small area round Hull; a somewhat irregularly-shaped district, including Boston, Derby, Birmingham, Warwick, Rugby, and Oakham; and a tongue-shaped tract of land stretching from the Isle of Wight to Basingstoke. From these districts the amounts reported generally reach or slightly exceed a tenth of an inch, and from two stations exceed ·25 in.

In Ireland, also, the month was phenomenally dry, the fall over the country generally averaging about ·25 in.; but in the S.W. and in the counties of Donegal and Fermanagh, and parts of Tyrone and Leitrim exceeding ·50 in.

Over Scotland the fall was more irregular, and over the N.W. half of the country was not greatly deficient. In the E. the falls roughly average ·25 in., and in the S.W. ·50 in.

Effective comparison of the fall over the country generally, with that of other exceptionally dry months, cannot be carried further back than the commencement of the Rainfall organisation in 1860,

but in the 31 years that have since elapsed, no parallel can be found. The nearest approach is September, 1865, which was a remarkably dry month; in most parts of England and Wales, unprecedentedly so.

Number of Stations having small falls in September, 1865 :—

Div.	County.	Below ·10 in.	No Rain.	Div.	County.	Below ·10 in.	No Rain.
II.	Hampshire	3	1	V.	Devon	25	15
,,	Kent	8	2	,,	Cornwall	4	0
,,	Sussex	14	3	,,	Somerset	14	7
III.	Herts	1	0	VI.	Gloucester	11	2
,,	Northampton ...	2	2	,,	Hereford	7	1
IV.	Essex	3	0	,,	Stafford	1	0
,,	Suffolk	8	2	,,	Worcester	1	0
,,	Norfolk	10	6	XI.	Monmouth	2	1
V.	Wilts	5	2	,,	Denbigh	2	1
,,	Dorset	8	3				

From this table, based on about 770 stations, we find that at 129, or 17 per cent., the fall was less than ·10 in., and that at 48, or 6 per cent. (of which 15 were in Devonshire), no rain at all fell.

The results for the month under discussion set out similarly are

Number of Stations having small falls in February, 1891 :—

Div.	County.	Below ·10 in.	No Rain.	Div.	County.	Below ·10 in.	No Rain.
I.	Middlesex.....	6	3	V.	Somerset	4	—
II.	Surrey	8	2	VI.	Gloucester	12	3
,,	Kent	9	2	,,	Hereford	2	—
,,	Sussex	5	2	,,	Shropshire	1	—
,,	Hants	5	1	,,	Staffordshire ...	1	—
III.	Herts.....	25	5	,,	Worcester.....	5	—
,,	Bucks	1	1	VII.	Leicester	1	—
,,	Oxford	3	2	,,	Rutland	2	—
,,	Northampton ...	2	—	,,	Lincoln	1	—
,,	Hunts	1	1	,,	Nottingham.....	2	—
,,	Bedford.....	4	3	,,	Derby	1	—
,,	Cambridge	2	—	VIII.	Lancashire	1	—
IV.	Essex.....	6	1	IX.	Yorkshire.....	10	4
,,	Suffolk	4	1	X.	Durham	2	—
,,	Norfolk.....	6	—	,,	Northumberland	3	—
V.	Wilts.....	5	1	XI.	Monmouth	3	—
,,	Dorset	3	1	,,	Glamorgan	1	—
,,	Devon	16	—	,,	Merioneth.....	1	1
,,	Cornwall	3	—	,,	Carnarvon.....	1	—

This table being based on the returns from only 220 stations, they are comparable only by means of percentages, the total returns of less than ·10 in. are 168, or 76 per cent., and of ·00 in. 35, or 16 per

cent., this latter percentage being almost equal to that of the returns under ·10 in. in September, 1865, viz.: 17 per cent.

The only other means of comparison is to select old-established stations, and to see what months in their records show a similar or greater deficiency of rain. For such a purpose one naturally turns first to the National Observatory, but only to meet with disappointment, for the Greenwich records are reliable for only 50 years, while the duration of those for Paris is nearer 200 years. However, we find the following months with less than ·25 in. :—

1852, March, ·17 in.
1855, April, ·09 in.
1857, Feb., ·20 in.
1865, Sept., ·16 in.

If we take the earlier years, from 1815-40, we have in addition—1817, April, ·10 in.; 1818, Aug., ·10 in; 1821, Feb., ·04 in.; 1825, July, ·10 in.; 1829, Dec., ·10 in.; 1833, May, ·20 in.; 1840, April, ·11 in.; but these figures are their own condemnation, for their very frequency is sufficient proof of their inaccuracy. The following table gives for a few long records the driest February and the driest month prior to 1891, with the duration of the record :—

Station.	Duration of record in years.	Driest February.		Driest Month.		February 1891.
		Amount. in.	Year.	Amount. in.	Date.	in.
Camden Square	33	·31	1862	·26	May, 1880	·01
Strathfield Turgiss	29	·60	1886	·22	July, 1885	·11
Hitchin	41	·11	1857	·10	July, 1885	·01
Bury St. Edmunds, Westley	34	·15	1857	·11	Sept., 1865	·06
Barnstaple	34	·59	1887	·26	Sept., 1865	·03
Tenbury, Orleton	60	·44	1887	·11	Sept., 1865	·07
Arncliffe	37	·37	1858	·00	May, 1853	·81
Haverfordwest	42	·85	1888	·30	April, 1854	·17
Llandudno	32	·44	1888	·13	Sept., 1865	·16
Cargen	31	·73	1888	·10	April, 1873	·28
Cork, Blackrock	31	·27	1888	·20	May, 1876	
Lurgan, Waringstown	29	·49	1888	·37	June, 1889	·36

These figures again, though representing the observations of a long series of years, show no indication of any month at all comparable with February, 1891.

OBSERVERS' NOTES.

WEST KENSINGTON, EDITH ROAD.—The rainfall for February is ·01 in., which fell on the 6th. I remember well that I felt very doubtful whether to enter that or not—it was certainly not a full hundredth. A rainless month has not occurred in London since July, 1800! so we may congratulate ourselves on having seen what hardly anyone living has seen before.—*G. von U. Searle.*

STROUD GREEN, MOUNT VIEW ROAD.—I have recorded no rain here during the entire month of February. The last rain fell on

January 31st. Moisture from the fogs was noted on 5 days, giving a total of ·035 in.—*Geo. T. Gwilliam.*

FINCHLEY, ETCHINGHAM PARK.—Enclosed are the returns, not of rainfall, but of drought, at this place and at Muswell Hill. What's to be done in these very extraordinary circumstances? Do you expect each of your observers who sends in a blank record to send you a pair of white kid gloves, the same as when a judge has no cases to try at an assize on the criminal side? Seriously, though, it must be bad for the country. Is it not curious that we should have had five dry Februaries in the last six years? This seems to me very much against taking so short a period as ten years as a basis of comparison.—*J. W. Scott.*

CRANLEIGH, HALL PLACE.—Literally, we had not a drop of rain throughout the whole month of February, a circumstance, I should think, quite unprecedented.—*E. S. Rowcliffe.*

SUTTON.—The only fall last month was on the 6th, ·01 in.; the last day I found ·04 in. accumulated condensation.—*William Goode.*

TENTERDEN.—Old gauge, ·10 in.; dew on 1st, 24th, and 25th; fog on 7th, 18th, 20th, 21st, and 23rd, also on 6th, when I have ·02 in. recorded, partly rain, and the only day with any. At Folkestone the total was ·09 in.; and ·02 in. rain on 14th. September, 1865, with ·06, is my only less month. Perhaps I was not careful as to dew then. My Snowdon gauge gives only ·06 in. on 6th, 7th, 20th, 21st, 23rd, and 24th.—*J. Ellis Mace.*

CRANBROOK, SWATTENDEN.—We had no rain in the month of February this year, excepting ·02 in. on the 6th.—*E. Appach.*

BECKENHAM.—Total rainfall, February 2nd, ·005 in.; 6th, ·007; 18th, ·003; total, ·015 in.—*Percy Bicknell.*

BECKENHAM, FOXGROVE ROAD.—An absolutely rainless February. The lowest records I have for that month since 1876 are ·56 in. in 1886 and ·57 in. in 1887.—*C. S. Pringle.*

WORTHING, HEENE.—The total rainfall for February here was ·09 in. on 6 days; and of this, ·05 in. on 4 days was due to the deposit of fog and hoar frost. The monthly gauge recorded the same amount, a somewhat remarkable fact for so dry a time. I have records since 1852, and no such dry February has ever been registered. I append a table of very dry months since 1852:—

1854.	·10 in.	during	5	days in	March.
1855.	·10 in.	„	2	„	April.
1865.	·10 in.	„	2	„	September.
1869.	·18 in.	„	4	„	July.

Wm. J. Harris.

CROWBOROUGH OBSERVATORY.—We have had an absolutely rainless month of February. The phenomenon of a rainless

calendar month has not occurred in Sussex since July, 1842, when there was no rain from June 30th to August 11th.—*C. L. Prince.*

SHANKLIN, BONDI.—I have not measured a drop of rain for the whole month of February.—*Alfred Parbury.*

HORNDEAN, ST. CATHERINE'S.—Our rainfall here last month was ·25 in.—*Mary C. Barnes.*

PETERSFIELD, COMPTON.—The rainfall of February is a curiosity, ·09 in. on 5 days.—*H. M. Langdale.*

ST. ALBAN'S, THE GRANGE.—Rainfall in February :—

6th	... ...	·02 in.
21st, 22nd, 24th	condensed fog	·01 in. ·01 in. ·01 in.
		·05 in.

Smallest falls on record at Herts stations in February :—Odsey Grange, ·23 in.; Throcking, ·24 in.; Much Hadham, ·26 in.; all in 1886. Smallest in any month: April, 1870, Cassiobury, ·08 in.; July, 1884, Hitchin, ·10 in.; Feb. 1857, Hitchin, ·11 in.—*John Hopkinson.*

ST. ALBANS, TORRINGTON HOUSE.—My rainfall return for February, taken on March 1st at 9 a.m. was precisely 0·035 in. in both jar and can gauges.—*Eleanor A. Ormerod.*

HITCHIN, THE FIRS.—On the 1st of February, just after 9 a.m., enough "rain" fell to make ·01 in. and so spoil my *carte blanche.* My friend, Mr. Lindsell, 400 yards north of me, who is a most accurate observer and has the best instruments, has scored *carte blanche* twice in 40 years. This month's max. temp. is unprecedented, 62°. Sulphur butterflies have swarmed during the last fortnight, and on the 16th a queen wasp was killed. Altogether, everything is out of gear, and we have had 21° at sunrise and over 50° at 1 or 2 o'clock. —*W. Lucas.*

ADDINGTON.—The long tract of dry weather we have had in this district is now fairly at an end. From the 31st of January until the 6th of March I had nothing to measure, but yesterday morning (7th) I had ·01 in. and this morning 0·34 in. 33 consecutive days without rain I imagine to be a rare occurrence in this country.—*John Mathison.*

KIMBOLTON, COVINGTON RECTORY.—It seems remarkable that the rainfall has been so tiny in almost every part of England. Here on the night of Jan. 31st it began to rain at 9 p.m.; how long it continued I cannot say, but at 3 a.m. it rained and hailed tremendously and kept me awake for an hour. On measuring the rainfall on February 1st, I found half-an-inch, of which a good deal fell on Feb. 1st. This I emptied. On measuring again, March 1st, I found ·30 in. —*Geo. F. Watson.*

ASPLEY GUISE.—I have not in February had any rain at all. There was some rain in the gauge on the morning of the 1st, which is, according to rule, reckoned to the 31st January, and unless this fell on this side midnight there has been absolutely no rain during the whole of the month.

This appears, from my record, extending from the beginning of 1856 to the present time, with the exception of the years 1866–67, to be quite unprecedented at this place.

My average for the month, according to the same record, is 1·50 in., and I have in my own 20 years (1871 to 1890 inclusive) had as little as ·40 in. in 1886 and as much as 3·54 in. in 1879.

Has anybody else noticed an extraordinary dryness of air in the last two days of the month? I was greatly surprised, on casually looking at the thermometers on the 27th, at 2.20 p.m., to find the dry bulb at 64° and the wet at 49°·5. It took two or three lookings to persuade me that I had not made a mistake. Glaisher's tables give for these temperatures a relative humidity of 37. What the drying power of such air may be I leave to more learned ones to determine.—*Edward E. Dymond.*

BEDFORD.—The entire absence of rain is notable here. At the Cardington Observatory, Miss McLaren had none; Mr. Godfrey, St. Peter's, had ·02 in., ascribed to dew and hoar frost. None has fallen in my gauge for 34 days, but for three or four days rain has seemed impending. The smallest rainfall previously at Cardington was in May, 1848, when only ·03 in. was measured.—*David Robie.*

SOUTHEND.—Last month I registered the extraordinarily small quantity of ·02 in. of rain, the lowest on my record, which dates back to 1875.—*C. J. Holthouse.*

DEDHAM, THE ROOKERY.—A month without a drop of rain is beyond my former experience, such has been this month of February. The moisture, ·09 in., registered on 9 days, being the result of the dense fogs so generally experienced.—*W. H. Penrose.*

IPSWICH, CLARE LODGE.—We had rain here on only one day in February, viz., on the 6th, measuring ·02 in. On the morning of March 2nd there was a slight fall of rain, which I estimate at not more than ·01 in., but the water in the gauge measured ·05 in. Of this, ·04 in. at least must have been fog condensation accumulated since the 6th February. It is very unusual to have fogs here such as those of last month, so that it never occurred to me to examine the gauge in the intervals of rain falling.—*E. R. Turner.*

GREAT YARMOUTH.—The rainfall for February, ·14 in. on 8 days, is the smallest monthly amount I have recorded.—*W. C. Steward.*

BRADFORD-ON-AVON.—Only ·01 in. of rain fell during February. It fell on the 3rd.—*E. M. Spencer.*

MARLBOROUGH, MILDENHALL RECTORY.—The driest month on

record. No rain. Only ·04 in. in gauge, from the accumulation of melted hoar frost.—*C. Soames.*

WIMBORNE, CHALBURY RECTORY.—We have not had a drop of rain or snow here since January 31st, and at this height we had hardly any fog.—*G. H. Billington.*

STURMINSTER NEWTON.—On February 7th there was a slight fall of rain in the morning, which turned to damp fog; ·02 in. was registered, which is the total for the month.—*Arthur R. Hallett.*

DEVONPORT WATER WORKS.—The rainfall for February having been so exceptional, I send the result of the month's gaugings at my three gauges:—(1). Rowden's Reservoir, Devonport: Total fall for month, ·02 in.; number of wet days, 2. (2). Lowery, Walkhampton: Total fall for month, ·09 in.; number of wet days, 1. (3). Cowsic Valley, Princetown: Total fall for month, ·70 in.; gauge taken weekly.—*H. Francis.*

WIDDECOMBE VICARAGE.—February a remarkable month. No rain since the 1st (·14 in.); very little wind; great stillness; frequent fogs, but (for the Moor) an extraordinary amount of sunshine. I do not remember a February at all like it.—*J. Williams.*

HONITON, IVEDON.—During February I recorded only ·01 in. of rain, viz., on 11th. The weather throughout was very like California coast winter climate—frosts, sometimes sharp, at night, and bright, warm days—all the frost disappearing by 11 o'clock. There were 20 days of bright sunshine, with scarcely any wind; that generally E. to S.E.—*G. E. Stanley.*

LOSTWITHIEL, LANWITHAN.—Seeing in your letter in the *Times* on "The Dry February" no return from Cornwall, I am sending you mine (·14in.), which I understand is more than some others. In June, 1887, we had only ·09 in.—*Mabel Foster.*

BRISTOL, OVER COURT.—Both my gauges, the one in the park, and the one in the garden, registered ·01 in. only during February. This was registered on the morning of the 2nd, and was, I think, due to condensed fog or dew.—*R. C. Cann Lippincott.*

COLEFORD, STAUNTON RECTORY.—Rain fell on two days only in February, viz., as taken at 9 a.m. on the 4th, ·01 in.; on the 8th, ·03 in. So total rainfall in month was ·04 in.—*C. J. Jones.*

CHELTENHAM, HEATH LODGE.—In February we had literally no rain. One day there was a slight snowstorm, which yielded ·02 in., and fog on three days yielded ·01 in., making a total of ·05 in. I have measured the rain for 40 years, and do not remember so small a quantity in any month.—*W. A Smelt.*

DILWYN.—Rainfall for February taken here: 8th, ·02 in.; 28th ·01 in.; total, ·03 in.—*T. Lambert Hall.*

CHEADLE, TEAN VICARAGE.—Total rainfall in February ·12 in., of which ·02 in. was deposited in the form of dew or fog. Maximum

shade temperature on 28th, 61°; the highest max. in previous 16 Februaries, 58°.—*G. T. Ryves.*

LEICESTER, ROTHERBY HALL.—I commenced a record of rainfall in January, 1869, and only once since then, viz., ·06 in. July, 1885, has the rainfall been as small as in February last; my record is ·12 in. on 6 days, but on 3 the water was more the accumulation from fog than absolute rain. On 21 days the temp. fell below freezing point, and we had much fog and very little sunshine until the 23rd; from then to the end of the month the middays were warm.—*Joseph Hames.*

STAMFORD, TOLETHORPE HALL.—Rain on 1st, ·01 in.; 8th, ·04 in.; total, ·05 in. I think this is quite unprecedented.—*C. O. Eaton.*

DERBY, HAZELWOOD.—In February, with my 5 in. gauge, I measured on the morning of the 9th, ·11 in.; 10th, ·01 in.; 14th, ·01 in.; 21st, ·01 in.; on 1st March, ·01 in,; total, ·15 in. My 8 in. gauge, which I examined on the 1st March, gave ·15 in. I hear from Mr. John Hunter, of Belper, that his gauge gave ·14 in. The only rain that fell was that mentioned on the 9th; the other quantities were, on 3 days, certainly fog or dew, though that measured on the 1st March I am not quite sure about.—*C. H. Burbidge Hambly.*

LIVERPOOL, HOPE STREET.—February rainfall, ·11 in. on 7 days. —*G. Jevons.*

CLITHEROE, DOWNHAM HALL.—Rainfall here in February, ·55 in., last year it was ·65 in. These are the driest Februaries I have recorded since I commenced observing in 1855.—*R. Assheton.*

YORK, BOOTHAM.—February, 1891, was rainless, so far as the rain gauge was concerned. A few drops, but very few, fell on the 11th, and at 6 p.m. on the 28th just a few spots on the pavement. About 3 a.m. on March 1st rather more fell, but the pavement, according to a policeman's report, was still dry at 6 a.m. The mean February rainfall for 50 years is 1·52 inches.—*J. E. Clark.*

HULL, MIDDLETON RECTORY.—The February rainfall has been abnormal, no doubt, all over the kingdom. My register is—Feb. 3rd, ·02 in.; Feb. 28th, ·04 in. But although there has been no rain on the other days, the thick fogs and hoar frosts have deposited moisture, I cannot say how much on each day. But on Feb. 21st there was ·02 in. in the gauge and on Feb. 28th, ·02 in.—*H. D. Blanchard.*

SUNDERLAND, WEST HENDON HOUSE.—The rainfall in February was ·04 in., part of which may have been condensed fog. The driest month I have recorded previously in my 31 years' observation was June, 1889, when the fall was ·24 in. There was no rain from the end of February until March 6th, on which date there was ·03 in. The total fall from January 21st till March 6th inclusive was ·21 in. We have now, however, had a sudden change, as it commenced to snow on the evening of the 7th, and by 8 a.m. on the 8th the snow was 14½ inches deep. This is the deepest fall I have ever known in

one day, though not the heaviest, as the snow was very light, being equal to about 0·94 in. of water up to 8 a.m. On the 8th it snowed nearly all day, with I am told a little rain, but the depth of snow diminished. In the 24 hours ending 8 p.m. on the 8th, the total fall would be about 1·43 in. of water, and in the 26 hours up to 10 p.m., when it practically ceased, 1·47 in., which is more than the total fall of the previous 71 days. The amount of melted snow in the 24 hours has been exceeded once before in my experience—viz., Nov. 12th, 1878, when the fall (which was 10½ inches) gave 1·63 in. of water.—*T. W. Backhouse.*

CORBRIDGE, BINGFIELD.—The rainfall at this place for February was only ·07 in.—*John Coppin.*

SWANSEA.—The rain here for February measured only ·14 in., which, I think, is the lowest on record.—*T. Travers Wood.*

LLANFAIRFECHAN.—Rainfall of February, ·09 in.: ·03 in. on the 3rd, ·03 in. on the 5th, ·01 in. on the 6th, and ·02 in. on the 13th. I have no previous record of so small a fall in any month, in any year.—*Richard Luck.*

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society was held on February the 18th, at the Institution of Civil Engineers, 25, Great George Street, Westminster, Dr. C. T. Williams, M.A., Vice-President, in the chair. Mr. C. L. Brook, Mr. C. E. De Rance, F.G.S., Assoc.Inst.C.E., Mr. J. Eden, Assoc.M.Inst.C.E., Mr. J. C. Mundell, and Mr. J. Sidebottom, J.P., were elected Fellows of the Society.

The following papers were read :—

1. "The Great Frost of 1890–91;" by Mr. C. Harding, F.R.Met.Soc. This paper dealt with the period from November 25th to January 22nd, and it was shown that over nearly the whole of the south-east of England the mean temperature for those fifty-nine days was more than 2° below the freezing point, whilst at sea-side stations on the coast of Kent, Sussex, and Hampshire, the mean was only 32°. In the extreme north of Scotland, as well as in the west of Ireland, the mean was 10° warmer than in the south-east of England. In the Southern Midlands, and in parts of the south of England, the mean temperature for the fifty-nine days was more than 10° below the average, but in the north of England the deficiency did not amount to 5°, and in the extreme north of Scotland it was less than 1°. The lowest authentic reading in the Stevenson screen was 0°·6 at Stokesay in Shropshire, but almost equally low temperatures occurred at other periods of the frost. At many places in the south and south-west of England, as well as in parts of Scotland and Ireland, the greatest cold throughout the period occurred at the end of November, and at Waddon, in Surrey, the thermometer in the screen fell to 1°, a reading quite unprecedented at the close of the

autumn. At Addington Hills, near Croydon, the shade thermometer was below the freezing point on 58 out of the 59 nights, and at Cambridge and Reading on 57 out of the 59. At Biarritz frost occurred on thirty-one nights; in the Shetlands on nine and at Rome on six nights. Although at many places in England the frost was continuous night and day for twenty-five days, at coast stations in the north of Scotland it in no case lasted throughout the twenty-four hours. On the coast of Sussex the temperature of the sea was about 14° warmer than the air throughout December, but on the Yorkshire coast it was only 6° warmer, and in the Shetlands and on parts of the Irish coast it was only 3° warmer. The Thames water off Deptford, at 2 feet below the surface, was continuously below 34° from December 23rd to January 23rd, a period of thirty-two days, whilst the river was blocked with ice during the greater part of this time. In Regent's Park, where skating continued uninterruptedly for forty-three days, the ice attained the thickness of over 9 inches. The frost did not penetrate to the depth of 2 feet below the surface of the ground in any part of England; but in many places, especially in the south and east, the ground was frozen for several days at the depth of 1 foot, and at 6 inches it was frozen for more than a month. In the neighbourhood of London the cold was more prolonged than in any previous frost during the last 100 years, the next longest period being fifty-two days in the winter of 1794–5, whilst in 1838 frost lasted for fifty days, and in 1788–9 for forty-nine days.

2. "The Problem of Probable Error as applied to Meteorology;" by Mr. T. W. Backhouse.

MERLE'S MS. OBSERVATIONS, A.D. 1337–1344.

WE are glad to say that through the help of our old correspondent Colonel Ward, this MS. has not only been found, but is already in process of being photographed, and has been deciphered and translated. This rapid action could not, however, have been secured without that which we desire at once to recognize, namely, the ready help of the authorities of Bodley's Library and of the University Press.

Colonel Ward has very kindly promised to guarantee us against pecuniary loss in the matter, but we shall not be surprised if the reproduction is effected without calling upon him at all.

There are ten sheets of vellum in the MS., and each of these will be photographed and reproduced as a collotype. There is the deciphering and translation to be paid for. There will be the printing of the translation, and of a title-page and (if materials can be found) an introductory note as to Merle and his MS., and the whole must be bound. The photographs will be large ones, 12 inches by 10 inches, and therefore the binding will be expensive. There will

also be the cost of distribution. Copies will be sent gratis to some of the principal meteorological establishments in the world, and to a few of the larger libraries, and the remainder will be appropriated to those who first apply for them and remit with their application the sum of half-a-guinea.

We have not seen the MS., and consequently offer no guarantee as to its quality; but it is more than five hundred years old, and is, we believe, far and away the oldest daily meteorological record in existence. Thanks to the excellent arrangements and very reasonable charges adopted at the Bodleian, we think that this can be reproduced at the low price we have above named, and we shall be surprised if many of our readers are not prepared to pay that sum for the curiosity.

We intend to reserve 10 copies for Colonial and Foreign correspondents (who will not be able to apply in time), but, with that exception, shall prepare only the gratuitous copies above mentioned, and those for which payment is made. Therefore no copies will be available for subsequent sale at any price whatever.

All applications to be made to G. J. Symons, 62, Camden Square, N.W.

BRIGHT METEOR DECEMBER 14TH, 1890.

To the Editor of the Meteorological Magazine.

SIR,—I believe that this meteor, referred to in the February number, was seen here. On the following morning the gardener reported having seen distant sheet lightning at 9.45 the previous evening. I accordingly filled up a thunderstorm form and posted it to the Royal Meteorological Society. A few days after I saw a report of the meteor in *Nature*, and, as the time corresponded precisely, I questioned him more carefully, when he told me that it was bright starlight at the time; he was out of doors, and suddenly noticed the sky lit up brightly, apparently to the southward; it seemed to flash up two or three times at intervals of a few seconds; the first impression it gave him was that it was a brilliant aurora. This is a long way from the other localities where the meteor was seen, but the time corresponds so closely that it seems probable that it was the same phenomenon.—Yours truly,

HENRY MELLISH.

Hodsock Priory, Worksop, 23rd February, 1891.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, AUGUST, 1890.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	79·7	5	40·4	31	69·9	52·5	52·2	78	124·6	38·4	1·55	13	5·9
Malta	97·5	25	64·8	29	89·1	70·5	69·0	69	149·4	59·0	·00	0	0·0
Cape of Good Hope	65·8	21	38·3	13	60·2	46·4	...	...	...	...	3·64	...	5·9
Mauritius	74·4	14*a*	56·2	30	73·0	62·5	58·9	76	128·2	49·0	2·22	22	5·6
Calcutta	89·8	4, 18	74·6	22	86·9	77·0	78·1	87	155·7	73·8	9·04	23	7·4
Bombay	84·9	25	74·0	2, 18	83·2	75·4	73·9	84	137·6	68·9	10·61	29	8·9
Ceylon, Colombo	86·7	25	74·6	11	84·8	77·0	70·2	75	147·0	70·0	·73	14	6·5
Melbourne	65·7	28	33·6	5	57·9	43·1	42·3	74	118·0	27·5	1·47	17	7·0
Adelaide	70·2	22	36·0	10	59·7	45·9	44·0	72	138·3	28·8	3·73	20	6·1
Wellington	63·3	12	32·0	15	57·1	42·1	40·7	73	115·0	27·0	4·16	13	3·8
Auckland	64·0	20	40·0	15	59·3	47·1	45·4	75	119·0	29·0	4·44	18	6·0
Jamaica, Kingston	92·3	15	69·3	4	89·1	72·6	70·0	70	...	...	5·23	...	...
Trinidad	90·5	1	60·0	26	86·3	68·9	72·3	82	155·0	60·0	11·65	22	...
Toronto	89·4	3	46·0	23	73·1	56·9	56·7	75	...	39·0	3·03	13	4·8
New Brunswick, Fredericton	88·2	4	43·0	19	73·3	54·5	57·0	74	...	...	5·88	15	6·1
Manitoba, Winnipeg	87·8	1	33·0	22	68·4	43·8	52·7	78	...	...	3·08	18	4·6
British Columbia, Victoria	...	...	...	...	...	...	...	...	...	...	...	...	...

a And 15, 27.

REMARKS.

MALTA.—Mean temp. 78°·9; mean hourly velocity of wind, 6·1 miles; sea temp. rose from 78°·5 to 82°·6; L seen on 22nd and 31st. J. SCOLES.

Mauritius.—Mean temp of air, 1°·6 below, dew point 0°·2 below, and R ·14 in. above their respective averages; mean hourly velocity of wind, 11·4 miles, or 1·0 below average; extremes 30·1 on 12th and 1·8 on 28th; prevailing direction, S.E. by E. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air and mean humidity same as the average. Dew point 0°·2 and cloud 0·9 above the average. R ·37 in. below average. Prevailing winds N. and N.E., strong on 12 days; frosts on 4 days; fogs on 2 days; heavy dew on 5 days; hail on 17th; T and L on 29th. R. L. J. ELLERY, F.R.S.

Adelaide.—A cold, wet month; mean temp. 1°·2 below average; R 1·40 in. in excess. C. TODD, F.R.S.

Wellington.—The first two days fine, then showery until the 7th; from 7th to 17th fine, afternoon of 17th, and 18th showery, then generally fine until the 27th, when it rained, and continued showery almost to the end. Prevailing N.W. wind, strong on 7 days; hail on 5th and 6th; fog on 10th; 2·35 in. of R on 3rd. Mean temp. 1°·6 above the average; R 1·05 in. below average. R. B. GORE.

Auckland.—A warm, moist month, with an unusual predominance of N.E. and E. winds. Mean temp. and pressure considerably above the average; R slightly in excess. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL, FEBRUARY, 1891.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in			in.
II.	Dorking, Abinger Hall.	·04	XI.	Builth, Llanwrtyd Wells	1·45
,,	Margate, Birchington...	·10	,,	Rhayader, Nantgwillt..	·24
,,	Brighton, Prestonville Rd	·01	,,	Corwen, Rhug	·00
,,	Hailsham	·05	,,	Carnarvon, Cocksidia ...	·32
,,	Ryde, Thornbrough	·15	,,	I. of Man, Douglas	·24
,,	Alton, Ashdell.....	·11	XII.	Stoneykirk, Ardwell Ho.	·44
III.	Oxford, Magdalen Col...	·00	,,	New Galloway, Glenlee	·78
,,	Banbury, Bloxham	·04	,,	Melrose, Abbey Gate...	·13
,,	Northampton	·03	XIII.	N. Esk Res. [Penicuick]	1·25
,,	Cambridge, Fulbourne..	·06	XIV.	Ballantrae, Glendrishaig	·38
,,	Wisbech, Bank House..	·05	,,	Glasgow, Queen's Park.	·54
IV.	Southend	·07	XV.	Islay, Gruinart School..	·86
,,	Harlow, Sheering	·01	XVI.	Dollar.....	·70
,,	Rendlesham Hall	·21	,,	Balquhidder, Stronvar..	2·01
,,	Diss	·07	,,	Coupar Angus Station..	·15
,,	Swaffham	·03	,,	Dunkeld, Inver Braan..	·32
V.	Salisbury, Alderbury...	·01	,,	Dalnaspidal H.R.S. ...	1·79
,,	Warminster	·01	XVII.	Keith H.R.S.	1·19
,,	Bishop's Cannings	·00	,,	Forres H.R.S.	1·41
,,	Ashburton, Holne Vic....	·07	XVIII.	Fearn, Lower Pitkerrie.	2·33
,,	Okehampton, Oaklands.	·09	,,	Loch Shiel, Glenaladale	8·73
,,	Lynmouth, Glenthorne.	·01	,,	N. Uist. Loch Maddy ...	3·66
,,	Probus, Lamellyn	·17	,,	Invergarry	5·58
,,	Launceston, S. Petherwin	...	,,	Aviemore H.R.S.	1·05
,,	Wincanton, Stowell Rec.	·05	,,	Loch Ness, Drumnadrochit	1·80
,,	Wells, Westbury.....	·01	XIX.	Lairg H.R.S.	...
VI.	Bristol, Clifton	·00	,,	Scourie	3·51
,,	Ross, the Graig	·01	,,	Watten H.R.S.	1·81
,,	Wem, Clive Vicarage ...	·15	XX.	Dunmanway, Coolkelure	·80
,,	Cheadle, The Heath Ho.	·06	,,	Fermoy, Gas Works ...	·61
,,	Worcester, Diglis Lock	·09	,,	Darrynane Abbey.....	·94
,,	Coventry, Coundon	·19	,,	Tipperary, Henry Street	·30
VII.	Ketton Hall [Stamford]	·09	,,	Limerick, Kilcornan ...	·18
,,	Grantham, Stainby	·16	,,	Ennis	·19
,,	Horncastle, Bucknall ...	·06	,,	Miltown Malbay.....	·53
,,	Worksop, Hodsock Priory	·08	XXI.	Gorey, Courtown House	·24
VIII.	Neston, Hinderton	·17	,,	Mullingar, Belvedere...	·29
,,	Knutsford, Heathside ...	·24	,,	Athlone, Twyford	·25
,,	Lancaster, Southfield ...	...	,,	Longford, Currygrane...	·22
,,	Broughton-in-Furness ..	·82	XXII.	Galway, Queen's Coll...	·32
IX.	Ripon, Mickley	·03	,,	Crossmolina, Enniscoe..	·25
,,	Scarborough, West Bank	·06	,,	Collooney, Markree Obs.	·27
,,	East Layton [Darlington]	·00	,,	Ballinamore, Lawderdale	·54
,,	Middleton, Mickleton..	·22	,,	Lough Sheelin, Arley ..	·26
X.	Haltwhistle, Unthank..	·22	XXIII.	Warrenpoint	·11
,,	Bamburgh.....	·12	,,	Seaforde	·29
,,	Shap, Copy Hill	·15	,,	Belfast, New Barnsley..	·17
XI.	Llanfrechfa Grange	·00	,,	Bushmills, Dundarave...	·29
,,	Llandovery	·30	,,	Stewartstown	·42
,,	Castle Malgwyn	·74	,,	Buncrana	·31

FEBRUARY, 1891.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date	Min. Deg.	Min. Date	No. of Nights below 32°. In shade.	No. of Nights below 32°. On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	·01	— 1·87	·01	7	1	61·2	28	24·2	23	14	22
II.		Maidstone (Hunton Court)...	·00	— 1·80	·00	...	0	...	...	...	...	...	...
,,		Strathfield Turgiss	·11	— 1·89	·05	28	4	64·0	28	23·3	27	19	23
III.		Hitchin	·01	— 1·74	·01	1	1	62·0	27	21·0	23	16	...
,,		Winslow (Addington)	·00	— 2·16	·00	...	0	66·0	27	19·0	25	19	23
IV.		Bury St. Edmunds (Westley)	·06	— 1·50	...	...	...	55·0	28	17·0	23	...	...
,,		Norwich (Cossey)	·03	— 1·56	·03	14	1	...	...	...	...	...	...
V.		Weymouth(LangtonHerring)	·03	— 2·57	...	...	...	53·0	27	28·0	10	11	...
,,		Barnstaple	·03	— 3·04	·03	21	1	67·5	23	27·0	10	...	..
,,		Bodmin (Fore Street)	·21	— 4·78	·16	11	5	...	...	...	...	...	...
VI.		Stroud (Upfield)	·00	— 2·56	·00	...	0	58·0	28	28·0	17*f*	18	...
,,		ChurchStretton(Woolstaston)	·06	— 2·39	·03	4	3	60·0	28	22·5	20	...	21
,,		Tenbury (Orleton)	·07	— 2·41	·02	8, 20	6	63·5	28	20·2	26	16	21
VII.		Leicester (Barkby)	·13	— 1·68	·12	8	2	60·0	28	17·0	23	21	26
,,		Boston	·77	— ·91	·70	1	3	65·0	28	22·0	23	15	...
,,		Hesley Hall [Tickhill].....	·02	— 1·48	·01	8, 27	2	63·0	28	22·0	26	16	...
VIII.		Manchester(PlymouthGrove)	·27	— 1·78	·17	3	6	58·0	28	27·0	18*g*	13	21
IX.		Wetherby (Ribston Hall) ...	·00	— 1·58	·00	...	0	...	...	...	...	...	...
,,		Skipton (Arncliffe)	·81	— 3·88	·26	4	8	...	...	...	...	...	...
,,		Hull (PearsonPark)	·17	— 1·63	·12	28	4	...	...	...	...	..	...
X.		Newcastle (Town Moor)	·10	— 1·30	·04	4, 12	3	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	2·60	—10·04	1·06	2	10	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	·05	— 3·14	·03	2	2	...	...	...	...	...	...
,,		Haverfordwest	·17	— 3·95	·05	2	8	51·0	21	24·9	17	12	21
,,		Carno (Tybrith)	·11	— 3·85	·05	28	3	48·0	24*c*	17·0	25	23	...
,,		Llandudno.....	·16	— 1·76	·10	3	3	67·0	22	31·8	21	1	...
XII.	SCOTLAND.	Cargen [Dumfries]	·28	— 3·37	·08	2, 3*i*	5	58·4	23	23·0	9	14	...
,,		Jedburgh (Sunnyside).....	·09	— 1·42	·06	21	2	61·0	23	22·0	9	15	...
XIV.		Old Cumnock	·47	— 3·03	·16	28	8	58·0	22	23·0	8	16	...
XV.		Lochgilphead (Kilmory).....	1·43	— 3·76	·36	28	11	...	...	27·0	11*h*	9	...
,,		Oban (Craigvarren)	3·80	...	1·03	2	15	58·0	24	33·2	27	0	...
,,		Mull (Quinish).....	2·38	— 3·09	·52	28	14	...	...	...	...	...	...
XVI.		Loch Leven Sluices	·70	— 2·05	·20	3*a*	4	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	·15	— 1·95	·05	3*b*	3	55·7	24	27·8	27	12	...
XVII.		Braemar	·23	— 3·13	·08	12	6	61·0	24	19·3	27	12	24
,,		Aberdeen (Cranford)	·27	...	·10	11	6	56·0	15*d*	26·0	26	11	...
XVIII		Strome Ferry.....	3·54	— 2·19	1·27	2	15	...	..	...	...	...	...
,,		Inverness (Culloden)	1·31	— ·53	...	...	...	61·0	24	27·0	21	4	17
XIX.		Dunrobin	2·88	+ ·79	1·16	2	7	56·0	15	27·0	13	5	...
,,		S. Ronaldsay (Roeberry).....	2·09	+ ·55	·74	11	12	52·0	19*e*	29·0	12	3	...
XX.	IRELAND.	Dromore Castle	·90	— 4·75	·25	1	5	60·0	24	31·0	3	...	...
,,		Waterford (Brook Lodge) ...	·33	— 3·75	·19	21	6	55·0	24	27·0	5	7	...
,,		O'Briensbridge (Ross)	·40	...	·12	7	8	52·0	4	31·0	5, 20	4	...
XXI.		Carlow (Browne's Hill)	·28	— 2·80	·06	21	9	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	·04	— 2·31	·02	13	2	61·9	23	30·1	9	2	17
XXII.		Ballinasloe	·24	— 2·54	·02	21	11	54·0	24	22·0	9	13	...
,,		Clifden (Kylemore)	1·12	...	·28	28	10	..	..	...	...	...	...
XXIII		Waringstown	·36	— 2·09	·09	21	10	62·0	24	21·0	9	14	18
,,		Londonderry (Creggan Res.).	·25	— 2·78	·06	7	11	...	...	...	...	..	...
,,		Omagh (Edenfel).....	·68	— 2·01	·19	11	10	56·0	24	24·0	8	9	13

a And 4, 12. *b* And 11, 28. *c* And 28. *d* And 16, 24, 28. *e* And 25. *f* And 18. *g* And 16. *h* And 26. *i* And 28.

+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON FEBRUARY, 1891.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

HUNTON COURT.—Not any R during the month.

STRATHFIELD TURGISS.—Chiefly remarkable for the very small amount of R and for the dense and continous fogs. These fogs were peculiar in their character, some neighbouring places on a higher altitude entirely escaping them. The bar. was very high and there was little or no wind. Honey bee seen on 15th; snowdrops in flower (wild) on 21st.

ADDINGTON.—Fogs frequent and often dense. From the 16th to the end frost every night, very sharp at times. In two respects this month stands quite alone as far as my observations go. It is the only month in which we have not had a single drop of R, and it had the highest shade temperature for the month of February—namely, 66° on the 27th and 64° on the 28th. During 21 years of regular observation at this station, 60° is the highest previously noted, and that only once, on the 17th of February, 1878.

BURY ST. EDMUNDS, WESTLEY.—The month was without any R, but ·06 in. was measured, which was produced by mist. I have kept the rain gauge since 1857, and this is the only month without any R. For some days in the middle of the month we had misty mornings with sunny afternoons. Bar. high, with very little variation.

LANGTON HERRING.—With the exception of a slight shower (less than ·01 in.) on the morning of the 14th, no R fell here throughout the month; the dew gauged was ·03 in. In 15 years the monthly falls below ·25 in. have been—May, 1876, ·18 in.; Nov., 1879, ·08 in.; Feb., 1891, ·03in. On four or five days there were fogs and mist, but with these exceptions it was a remarkably fine month. From the 2nd to 25th the bar. was uniformly very high, and the mean ·15 in. higher than the next highest in the last 10 years, Jan. 1882. Mean temp. at 9 a.m. 2° below, mean min. 2° below, but mean max. very slightly above the average.

BODMIN, FORE STREET.—A remarkably dry month; many frosty nights and splendid sunshine by day; some days very warm, quite like June, especially the 26th and 27th. The driest February on record, and the least R in any month except ·10 in. on 4 days in June, 1887. Thick mist on the 2nd, 3rd, 4th, and 7th, and on 11th showers in the night, the only R during the month.

STROUD, UPFIELD.—A most beautiful, fine, dry February. Bright sunshine with slight frosts at night and no wind. No rain.

WOOLSTASTON.—An exceptionally dry month, slight showers falling on three days only, in the early part of the month. Sharp frosts on the grass on most nights and much fog on the lower grounds. Mean temp. 41°.5.

ORLETON.—The driest month recorded in 60 years, the total fall being only 0·07 in., of which more than one-third was fog. The max. temp. on the 28th, 63°·5, was the highest for 35 years in February. The mean temp. for the first 14 days was above the average, but although the days in the latter half of the month were warm, there were severe night frosts, so that the mean for the month was nearly 4° below the average.

LEICESTER, BARKBY.—A month remarkable for the following facts:—Very dry; barometer very high; frosts and fogs almost every night and morning, till nearly noon; the rest of each day being very fine. Mean max. 47°·2; mean min. 28°·4.

BOSTON.—A month of high barometer, small rainfall, calm air, and dense fogs, with occasional bursts of sunshine. Temperature below the average.

HESLEY HALL [TICKHILL].—A month remarkable for the entire absence of R, very heavy fogs, and hoar frost; the last fortnight foggy entirely, except two or three hours in the afternoons.

MANCHESTER, PLYMOUTH GROVE.—The smallest R in February for 25 years. Dense fogs on 16th, 18th, 19th, 20th, and 24th. Mean temp. 40°·8.

WETHERBY, RIBSTON HALL.—No R since January 25th. I have recorded the rain for nearly 20 years, but never had a clear monthly sheet before this.

HULL, PEARSON PARK.—The weather during the month has been remarkably dry and calm with a small amount of cloud, but frosty and very foggy from the 16th to the end of the month.

NEWCASTLE, TOWN MOOR.—The R for the month is the lowest ever registered at this station; the record beginning in 1868.

WALES.

CARDIFF, ELY.—Brilliantly fine; sunshine nearly all the month, with cold nights and white frost in the early mornings.

HAVERFORDWEST.—Fine, but cold, bright weather characterised this month. The R was the least recorded in any month during the last 42 years, except the month of May, 1859, when none fell. The barometer was very high during the whole month, the highest reached was 30·750 ins. on the 22nd (corrected). On some nights the frost was sharp, the lowest grass temperature being 21°·3 on the 18th. A fine time for ploughing and dressing the arable lands.

SCOTLAND.

CARGEN.—The most notable features of the month were the unusually high bar. and the very slight R. The mean of the bar. (corrected) was 30·413 in. The only other occasions when the pressure came near this were November, 1867, 30·189 in.; November, 1879, 30·181 in.; February, 1890, 30·186 in. The R was the lowest recorded in any month, except April, 1873, when only ·10 in. fell. In only five months during the last 31 years has the R been below ·50 in. Fog prevailed to a considerable extent. The wind on 22 days was very light, not reaching force 1. Very sudden changes of the temp. occurred on several days, the range on 20th being 30°·2, and on 26th 28°·4. Mean temp. for the month, 39°·4.

OBAN.—The month as a whole was very fair and warm, during the latter half unprecedentedly so, almost reaching summer heat and causing everything to bud, and blossoms even were frequent. The R, however, considerably exceeded that of 1890, and the temp. was higher.

ABERDEEN, CRANFORD.—An exceptionally fine month.

INVERNESS, CULLODEN.—A fine month in every way, and out-door work well forward. Little R, no snow, no fog.

DUNROBIN.—Very fine and mild.

S. RONALDSAY, ROEBERRY.—With the exception of a few days in the middle of the month, it was the finest February for many years. Wind light and generally from S. to S.W. Snow storm on 11th and 12th.

IRELAND.

DROMORE.—A very fine month. Vegetation setting in from the middle of the month and towards the end exceptionally forward.

WATERFORD, BROOK LODGE.—The driest February for over 32 years. Fog on several mornings. Mean temp. 43°·9

O'BRIENSBRIDGE, ROSS.—Without exception the finest February on record in this country, only four nights of frost, and those slight.

DUBLIN.—February, 1891, proved a record month for drought, mildness, calm, and fogginess combined. Mean Temp. 44°·7, being 1°·9 above the average. Mean Bar. 30 398 in. or ·543 in. above the average. The R for the month is probably unparalled, the nearest approach to this drought was Sept. 1865, when ·056 in. was measured on three days. There was no S, Sleet, or H. Fogs on 16 days. High wind on 8 days, reaching the force of a gale on 11th. The temp. exceeded 50° in the screen on 14 days and fell below 32° in screen on 2 days.

BALLINASLOE.—Very fine, with the smallest R during any month of the last 18 years, the nearest approach to it being ·42 in. in June, 1887.

EDENFEL.—A month of phenomenal fairness, calm, fine, and frequently bright. What little R there was fell chiefly at night, and to the ordinary observer did not disturb the even tenor of its way.

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THE GREAT SNOWSTORM OF MARCH, 1891.

THE snowstorm of January, 1881, had more than one beneficial effect. It showed us that the stories handed down from remote ages of roads blocked for weeks, of thousands of sheep buried in a single county, of coaches and carts with their horses and drivers perishing on the highways, were probably not exaggerated, and therefore our ancestors were more truthful than had been imagined. That 1881 storm should have had another good effect—to arouse rainfall observers to a sense of their duties in the matter of observing snow, and the very difficulties they then had to encounter should have made them more careful, and have improved the character of subsequent records.

It is as yet too early to determine how much better prepared our staff has been to grapple with the storm of 1891 than it was with that of 1881; that we shall find out later on. Meanwhile, we will endeavour to deal with the March, 1891, snowstorm in two respects.

INCONVENIENCE AND DAMAGE CAUSED BY THE STORM.

(Based chiefly on Newspaper Reports.)

The following details for one parish—Kensington—will give some idea as to the total cost of the removal of the snow in London :—Total loads removed, 10,689; cost thereof, £3,741. Salt used, 40 tons. Extra men employed, 6,963, at a cost of £1,044.

A man was found dead in the snow near Dorking.

Drift at Dulwich, 11 ft. deep.

A L.B. & S.C.R. train was blocked as near London as Beddington, and had to be left for the night.

Train in Saltwood Tunnel (Hythe) all night; tree with a trunk 3 ft. in diameter blown across the line in front, rear blocked by S.

Folkestone, 9th, 8 p.m., S = 6 in. deep.

Near Shepherdswell snowdrift on line, 14 ft. deep.

Dover, terrific gale and S at midnight 9th–10th.

Dover and Deal line blocked for some hours.

At one village near Dover a cottage surrounded by 12ft. of snow.

Elham Valley line, Dover to Canterbury, closed all the 10th.

Last train into Faversham blocked 2 miles outside the town; and passengers had to stop in it nearly all night.

At Oakleigh, near East Grinstead, a 3-year old garden wall, 270 ft. long and 15 ft. high, with a 2½ ft. glass coping, was all blown down.

Both up and down Parcel Post road vans London–Brighton were blocked within half a mile one of the other, near Handcross.

Newhaven train buried from 11 p.m. till 5.30 a.m.

A Coastguard man buried in snowdrift near Beachy Head.

An Isle of Wight train ran into a drift at Merstone, between Sandown and Newport, and passengers had to stop in it all night.

Mail train London to Portsmouth, due at midnight, went off line in the S, and only got in about 4 hours late.

On Tuesday night G.W.R. train blocked between Newbury and Didcot.

Marlboro' and Andover line blocked.

G.W.R. blocked between Heytesbury and Westbury on Salisbury–Bristol line.

Amesbury, S drifts = 12 ft. deep.

Somerset and Dorset line blocked; no traffic between Bournemouth and Bath.

At Plymouth great damage was done both by snow and wind. One woman was frozen to death in a public square. Much trouble also arose through the water supply from Dartmoor, which runs in an open channel, being impeded by ice and snow so that the supply was cut off. A batch of workmen was sent to clear it, but no food was sent with them, and after about 12 hours' exposure to cold and hunger most of them deserted. The next day (Thursday) 500 soldiers and navvies, with the Mayor, and ample provisions, were sent to the nearest point a train could reach, but they did not clear the channel until Friday night.

Six G.W.R. trains blocked between Exeter and Plymouth. S 26 ft. deep at Bittaford, between Ivybridge and Brent.

The G.W.R. "Zulu" leaving Paddington 3 p.m. Monday, 10th, for Plymouth was blocked at Brent until Friday, 13th, when it was released and reached Plymouth at 8.30 p.m.

Two engine drivers and a fireman were dug out of a drift near Hemerdon, nearly dead; one delirious.

In the Hemerdon drift, at 10 p.m. on the 12th there were six engines and several snow ploughs buried.

The G.W.R. company are stated to have had 1200 men on the block near Hemerdon. No up mail passed by this line between the 9th and the night of the 13th.

At Torquay the fall in sheltered spots was 15 to 30 inches, and in drifts several feet.

At Dartmouth the drifts were from 10 to 12 ft. deep.

The various parks near Plymouth suffered severely; in one alone

upwards of 1000 trees were uprooted; in another an avenue of sixty limes was entirely swept away.

On the Dartmoor line a train was snowed up for three days; there were only six passengers, four men and two women, and they had to pass two nights and one day in the train, with only one slice of bread and butter and one piece of cake each. There was a farm house within 200 yards, but the passengers could not get out, and the farmer did not know that the train was there.

Even on the 12th fresh blocks occurred in Devon. A full (L. & S.W.R.) train (with 50 women) left Devonport at 2.30 p.m. on 12th for Okehampton; it took 3½ hours to do 30 miles and then stuck, it and the passengers being buried for 20 hours.

Two up G.W.R. trains blocked between Exeter and Taunton.

Another train was blocked at South Molton.

The Hemyock branch of the G.W.R. was not open on 12th.

S began at Penzance 4 p.m. 10th, and by night, roads all blocked, S 8 ft. deep. The 11 a.m. G.W.R. express, which got through Ivybridge 4 hours before the "Zulu," was blocked at Camborne, and several other trains were blocked in that neighbourhood.

Near St. Columb Minor one man was frozen to death.

Near Hayle a train was deserted and left in a drift; the gang of men sent to dig it out could not find it, and gave up the search.

Near Bude, on the night of 12th, nearly all the roads were still blocked with drifts 10 ft. to 15 ft. deep.

Shepton Mallet, drifts so deep that no train was expected for three days; several drifts were more than 20 ft. deep.

Somerset and Dorset line was blocked between Bristol and Wimborne.

On the West Somerset one train was blocked at Dunster and another at Watchet.

Near Bristol, in one cutting a mile long, the average depth was 12 ft.

Bristol, S storm for 20 hours; street traffic stopped.

Details of the Storm.

(Notes from our own Correspondents.)

Camden Square, London.—Average depth of snow 5 inches, yield ·55 in., giving 1 inch of R for each 9 inches.—*G. J. Symons.*

Elleray, Etchingham Park, Finchley.—S on 9th and 10th, estimated depth, 6 in., but much drifted. S remained in the railway cutting between East Finchley and Finchley Station till the afternoon of the 24th.—*J. W. Scott.*

Leatherhead.—Depth of S here, 7 in.—*A. T. Miller.*

Prestonville Road, Brighton.—A great S storm and gale on the 9th. S on 10th 4 in. deep.—*H. Phillips.*

CROWBOROUGH OBSERVATORY.—Great S storm; roads blocked; average depth on morning of 10th, 6 inches. The snow was very dense, a 6-inch cylinder, when melted, yielding 1·30 in., or one inch of water for 4·6 inches of snow.—*C. L. Prince.*

REDLANDS, EMSWORTH.—S storm of the 9th and 10th caused drifts 4 to 5 ft. deep, and on 31st some of the S drifts remain unmelted.—*F. Jacomb Hood.*

ASHDELL, ALTON.—14 in. of S fell 9th and 10th.—*F. Crowley.*

ST. GILES'S, OXFORD.—9th and 10th, the blizzard was not so fierce as that in 1881, and there was not nearly so much snow.—*A. R. Tawney.*

BLOXHAM GROVE, BANBURY.—Gale on 9th from N.E., and on morning of 10th it blew hard, with driving S, and there were in places drifts from 2 to 3 ft. deep.—*G. Warriner.*

ALDERBURY, SALISBURY.—9th, storm and fall of S, and on 10th heavy storm and fall of S; roads blocked with drifts.—*R. S. Hutchings.*

BISHOPS CANNINGS, DEVIZES.—9th and 10th, S about 4 in. deep.—*C. W. Hony.*

BLOXWORTH HOUSE, WAREHAM.—Great S storm; average depth 12 in.—*J. P. Cambridge.*

HAZELBURY BRYAN, DORSET.—Heavy S began to fall on 9th, roads blocked on 10th, and all communication with the outside world suspended.—*R. F. Wheeler.*

IVYBRIDGE.—My calculations for this month are much thrown out by the great storm of the 9th and 10th inst. The rain gauge stood in a very few inches of snow; N.E. of it, about 30 yards off, was a drift 20 ft. deep; W. of it, the snow increased in depth up to and above the entrance gate, about 8 or 9 ft. A train was snowed up in a drift 15 ft. deep, and at least 100 yards long, about 200 yards from the house. The storm lasted here just 36 hours—from noon on Monday, 9th, to midnight of Tuesday. An old man, near by, tells me that he remembers as much snow in the lanes *once* in his life; when he was about 10 years old, and that was about 54 years ago; it was in *April*. Is this a storm which you can identify? I hear another old man in Ivybridge thinks that there was a great storm of snow in 1839 or 1840.—*M. A. Glanville.*

TORQUAY.—Slight snow fell from 0.35 to 0.45 p.m. on the 8th, snow and rain showers from 11.35 a.m. to 0.23 p.m. on the 9th, and snow from 0.26 p.m., 9th, to 10 p.m., 10th, and was very heavy at times from 3 p.m., 9th, to 4.40 p.m., 10th; soft hail fell from 10.55 to 11.30 a.m. on the 10th. The snow began to cover the ground at 5.30 p.m. on the 9th, and attained a depth (on the level) of 6 in. at 9 a.m., and 1 ft. at 9 p.m. on the 10th, which was by far the greatest

depth observed here since the observations were begun in August, 1876. A terrific E.N.E. gale, which accompanied this unprecedented snowstorm, caused immense snow-drifts, which attained a depth of 8 ft. on the Warberry Hill, completely blocking the lanes and roads. Fog prevailed from 5.30 to 6.5 p.m., 9th, and 1.25 to 1.45, and 2.45 to 4.30 p.m. on the 10th. The weight of the snow, and the tremendous gale on the 9th and 10th, threw down or broke great numbers of trees and shrubs; and the sea was very rough and tides high carrying away large quantities of the Babbacombe beach.—*E.E.Glyde,*

HOLNE VICARAGE, ASHBURTON.—9th and 10th, rain gauge, 18 in. high, completely embedded in the S.—*J. Gill.*

DRUID, ASHBURTON.—The quantity of S on 9th, 10th, and 12th could not be measured, owing to the great drifts; the depth on 10th estimated at average 2 ft. 6 in., and on 12th 6 in.; many roads remained blocked to the end of the month.—*F. Amery.*

TREWIRGIE, REDRUTH.—The storm commenced on Monday, March 9th, about 11 a.m., and soon became a regular blizzard, and by the evening the snow, which was exceedingly fine, had accumulated in enormous drifts, so much so that in this short space of time the G.W.R. main line was completely blocked on both sides of Redruth Station, and vehicles in the streets and roads were so completely snowed up that they had to be left there, and were not dug out until the following Friday. Out of five consecutive days in this week snow fell heavily for the greater part of four. The damage on land and sea was unprecedented, and the woods and shrubberies in the neighbourhood are completely wrecked, the damage being enormous. The following are the measurements of the gauge :—

			Snow.
Monday	1·28	=	15·36
Tuesday	·20	=	2·40
Wednesday	·00	=	·00
Thursday	·66	=	7·92
Friday	·11	=	1·32
	2·25		27·00

My gauge is placed so as to be free from drift, and the gauge was frequently verified by actual measurements of the snow on the ground. On the 17th, 18th, and 19th January, 1881, 1·31 in. of melted snow was registered, and this would make 15·72 in. of snow, so that the present storm fairly surpassed the memorable storm of 1881 in every particular. The drifts ranged in depth from 3 to 15 ft. in most districts. For a fortnight or more after the 9th the roads were in many places impassable, and even now (March 25th) in many places the drifts are very large. Indeed, probably no such storm, combining a very heavy snowfall with such a gale, has occurred in the West of England in the memory of the oldest inhabitant.—*Alfred H. Jenkin.*

[Mr. Jenkin seems to have assumed throughout that both in 1881 and on all the days in 1891 the density of the snow was such that

12 inches of snow equalled one inch of water. That is the average, but individual falls differ enormously, and we shall be glad if he will favour us with the details of the verifications he refers to, as they are most important, and at present we have only two observations of that character.—ED.]

STOWELL RECTORY, TEMPLECOMBE.—Gale and S storm on 9th and 10th; the S drifts were in places 8 or 10 ft. deep.—*H. J. Poole.*

HALSE HOUSE, NEAR TAUNTON.—The storm began on Monday the 9th, about noon, and continued till midnight of Tuesday—36 hours, without intermission. The road through this village of Halse, seven miles west of Taunton, was blocked up for two days, so that there was no communication with our post office at Bishop's Lydeard till Wednesday evening. But to the east of that place, the Taunton side of it, the fall was much greater than here; so that for several days the road was impassable. Mr. Hancock, of this village, taking the average of several places on his premises, and reckoning an inch of water to a foot of snow, registered on Tuesday the 10th, ·90, and on Wednesday the 11th, ·40. A good many birds have been killed. The gardener has found them in cutting back ivy bushes, sitting two together. But the mortality has not been as great as in Hampshire, and in some other counties. A self-registering thermometer on the north-side of an alcove, indicates 12° as the lowest temperature since the beginning of December, and I believe that the birds have perished from hunger, more than from cold. We have many thick hedges of holly, and in these they are likely to have found shelter. The plants have scarcely suffered at all. Two myrtles on a south wall are nipt, but not killed, and other half-hardy shrubs, as sweetbay, laurestinus, and Japanese spindle, are untouched.—*R. C. A. Prior.*

WELLS, SOMERSET.—The S storm of the 9th and 10th caused nearly all the bye-roads to have drifts level with the top of the hedges. One on the Wookey Hole was reported as 20 ft. deep; at the same time, a field close by was bare.

CLIFTON, BRISTOL.—9th and 10th, average depth of S, 9 in. The fall continued with little intermission from 4.30 p.m. on the 9th till 7 p.m. on the 10th.—*G. F. Burder.*

FURTHER BARTON, CIRENCESTER.—The S storm of the 9th and 10th was not so severe as at some places, but many country roads were blocked with drifts for a day or two. S was still to be seen in ditches as late as the 25th.—*Miss Brown.*

THE GRAIG, ROSS.—The blizzard of the 9th—7.30 to 8.30 p.m.—will long be remembered for violence of wind and amount of drifted S; though not so bad as Jan. 18th, 1881, it was 9½ in. deep on both sides of the house, and in exposed places, nearly 11 in.—*H. Southall.*

KETTON HALL, STAMFORD.—S on night of the 9th, which at 9 a.m. on 10th was 4 in. deep, and lay in some places until 16th.—*F. Coventry.*

LLANFRECHFA GRANGE.—9th, S began about 7 p.m., lasted all night, and on the 10th was 8½ in. deep; as the wind blew hard, it drifted greatly, and the roads were much blocked.—*F. J. Mitchell.*

THE HENDRE, MONMOUTH.—On the evening and night of the 9th, there was a severe S storm, accompanied by a gale. Depth of S, where undrifted, slightly over 1 ft.—*J. M. Rolls.*

LLANVIHANGEL COURT, ABERGAVENNY.—N. to E. gales on nights of 9th and 10th. The S on 9th appeared to be a heavier fall than on the 8th of Jan., when the gauge registered more; this was due, I think, to the high wind. Inverting gauge gave ·57 in.; measurement 10 in. gave ·83 in.—*Col. Sturt.*

CLEGHORN HOUSE. HAVERFORDWEST.—I timed my return journey home from London, unfortunately, just to get into the terrific snowstorm of Tuesday. I left London on Monday afternoon, and stayed at Gloucester the night. Snow began falling there 8.15 p.m., accompanied by a piercing gale from the E., and by 8 a.m. Tuesday the snow on the level was about 9 in. in depth. I left Gloucester at 1 p.m., and fortunately got home safely without detention or casualty. The earlier trains had been detained up from S. Wales, between Neath and Newport (Mon.), but energetic measures had been taken to clear one line of rails. Before I reached Pembrokeshire the snow had ceased falling, although I could see enormous drifts and roads filled up as I came along.—*E. P. Phillips.*

GENERAL CONCLUSIONS.

Besides the information given in the previous sections, there is that given in the "Notes on the Month" by our regular correspondents.

We have considered the data already received, and proceed to state the conclusions to which we have been led; but obviously these may have to be modified when, instead of the reports from perhaps 50 observers, we have them from the whole of those (about 900) in the area over which the storm swept.

The area visited seems to have been a belt about 120 miles wide, extending from about Cheltenham on the N. to Jersey on the S., or say from Colchester on the N. to Dieppe on the S., and reaching from the South of Ireland eastwards to Holland.

We do not issue a map with this number, as we did with that referring to the storm of 1881, because we think it better to defer it until all the information has been received and tabulated for *British Rainfall*, 1891, and also because, as just stated, the area is apparently a very simple one, easily defined without a map.

The snow was much deeper in Cornwall and Devonshire than anywhere else. Although Mr. Glyde puts the Torquay fall at only 1 foot, we are inclined to think that the average for the whole country S.W. of the railway from Exeter to Barnstaple was nearly

or quite 2 ft. We think that there is no doubt that in Cornwall the storm of 1891 far surpassed that of 1881, and possibly in parts of Devonshire this was also the case. As regards wind force also, the storm was exceptionally bad in Cornwall, causing many wrecks. The stoppage of the Plymouth water supply occurred in both 1881 and 1891; in the former year it was stopped for 5 days, in 1891 for 4 days.

We are very sorry that up to the present time we have *only three* records of the density of the snow. Mr. Jenkin seems to have made some, but has not quoted them, and of the others Colonel Sturt's gives exactly the 1-12th, Mr. Prince's 1-5th, and Mr. Symons's 1-9th.

COLDEST MONTH.

To the Editor of the Meteorological Magazine.

SIR,—I take the liberty of sending you a statement of the mean temperatures of all Januaries and Decembers from 1872 to 1890 inclusive, in corroboration of my remarks as to which is the coldest month in the year.

	JANUARY. Mean of each Year.	JANUARY. *Average Mean.	DECEMBER. Mean of each Year.	DECEMBER. *Average Mean.	Average Mean of January as compared to that of December.
1872	38·2	38·20	38·0	38·00	+ ·20
3	37·9	38·05	40·4	39·20	— 1·15
4	39·2	38·43	28·1	35·50	+ 2·93
5	39·5	38·70	36·1	35·65	+ 3·05
6	35·8	38·12	38·9	36·30	+ 1·82
7	37·8	38·07	38·9	36·73	+ 1·34
8	37·5	37·99	27·6	35·43	+ 2·56
9	27·5	36·68	30·1	34·76	+ 1·92
1880	33·6	36·33	39·1	35·25	+ 1·08
1	26·8	35·38	36·3	35·35	+ ·03
2	40·4	35·84	36·1	35·42	+ ·42
3	40·0	36·18	39·2	35·73	+ ·45
4	42·3	36·66	36 5	35·79	+ ·87
5	35·4	36·56	37·1	35·88	+ ·68
6	34·3	36·41	33·7	35·74	+ ·67
7	35·0	36·32	35·8	35·74	+ ·58
8	36·9	36·36	39·5	35·96	+ ·40
9	38·1	36·46	36·7	36·00	+ ·46
1890	41·1	36·70	31·0	35·74	+ ·96

* The average means are those of all years up to date inclusive.

You will see that at no period since the end of 1873 has the average temperature of all previous Decembers equalled those of the Januaries during 19 years.—Yours truly,

SAMUEL KING.

Elswick Lodge, March 5th, 1891.

EXCEPTIONAL WEATHER RECORDS, 12 YEARS, 1879-91, AT OLD PARK, RUSPER, SUSSEX,

34 MILES SOUTH OF LONDON, 372 FT. ABOVE SEA LEVEL (THERMOMETER FACING N.)

Date of occurrence.	Heavy Rains. inches.	Heavy Snowfall. Depth.	Great Gales, &c.	Great Drought and Heat. In Shade.	Great Cold. No. of Frosts in Month, &c.
1879 May 28	1·50 12 hrs.				
1880 May 26				Max. 77°	
Sept. 4				Max. 80°	
Oct. 20		4 or 5 in.			
1881 Jan. 18		Over 2 ft.	Very strong E.		Min. 7°
July 15				Max. 93°	
1883 March					28 frosts
Sept. 2			S.W. heavy		
1884 Jan. 23–27			S.W. very violent		
April 20					Severe frosts
Aug. 8 & 9				Very hot. Max. 86°	
1885 March 22		5 in.			
July				Very dry. Rain only ·24 in.	
Sept. 27					Severe frosts
1886 March 30			S.W. very heavy		
Oct. 4				Very hot. Max. 74°	
Dec. 9			Severe gale S.W.		
Dec. 26	2·75. 15 hrs.	With rain			
1887 Mar. 13, 14					Very cold. Min. 19°
July, Aug				Very hot; 33 days of absolute drought	
October				Severe drought	
Oct. 12, 13					Very cold. Min. 24°
Nov. 17					Very cold. Min. 18°

Date of occurrence.	Heavy Rains. inches.	Heavy Snowfall Depth.	Great Gales, &c.	Great Drought and Heat. In Shade.	Great Cold. No. of Frosts in Month, &c.
1888 Feb. 22–25..	.....	.....	Piercing N.E.	.....	Blizzard. Min. 17°
1888 March 11 ...	.....	.....	Great storm S.W.		
April 12 ...	.....	Deep on 8th	.....	.....	Very severe. Min. 24°
July 12... ..	.....	Snow fell	.....	.....	Min. 38°
Oct. 3 to 8..	.....	.....	.....	.....	Very cold
November..	4·10	.....	Gales S.W.—W.		
1889 May 22 to 25	.....	.....	.....	Very hot. Max. 78° on 23rd	
May 26.....	1·70. 8 hrs.				
June 7	·88. 30 mins.*				
Sept. 2 to 19	.....	.....	.....	Severe	
Sept. 10 to 13	.....	.....	.....	Mean temp. 63°·2	
October.....	R. 6·01				
November..	.....	.....	.....	Absolute drought 18 days	
1890 Jan. 26	.....	.....	Very violent		
March 1 to 4	.....	.....	.....	.....	Very severe, min. 14° on 4th.

HEADLEY, HANTS, MILES 47 S.W. OF LONDON, 252 FT. ABOVE SEA LEVEL.

1890 August 31 ..	.....	.....	.....	.....	Frost
Sept 17.....	.....	.....	.....	Absolute drought 21 days	
Nov. 28.....	.....	.....	.....	.....	Sudden. Min. 14°
Dec. 19.....	.....	4 in.			
Dec. 22.....	.....	.....	.....	.....	Min. 11°
December	.....	.....	.....	Absolute drought 5th to 21st 15 calm days	Mean 26°·9
1891 Jan. 1 to 20...	.....	.....	.....	Absolute drought 15 days	Mean 26°·1
January ...	.....	.....	.....	10 calm days	Min. 14° twice
February	.....	.....	.....	Absolute drought 21 days R. only ·07 in. 11 calm days	

* At Rusper Rectory, 1 m. N., 2.20 in. in 1¼ hrs.

Summary, Old Park, Rusper and Headley, Hants, 12 Years.

Max. Shade Temp., 93°, July 15, 1881
Min. 5 ft. from ground, 7°, Jan., 18, 1881.
Max. Rain in Month, 6·96 in., Oct., 1880.
Max. Rain in Shower, 2·20 in., 1¼ hrs.; and ·88 in., 30 mins., June 7, 1889.
Longest Absolute Drought, 33 days, June 3 to July 5, 1887.
Longest period of Dry Weather, ·62 in. R in 72 days, June 3 to Aug. 16, 1887.
Driest Months, July, 1885, R ·24 in. (2 days); Feb., 1891, ·07 in. (2 days).
Wettest Season, Summer of 1879, viz., June (5·50), July (4·48), Aug. (5·50); total R, 15·48 in.
Hottest Month, Aug., 1884, mean 62°·9.
Coldest Month, Dec., 1890, mean 27°·0.
Heaviest Gales, Jan. 24 & 27, 1884, March 11, 1888, Jan. 26, 1890.

THE SIGNAL SERVICE, U.S.A.

THE law transferring the U.S. National Weather Service from the War Department to the Agricultural Department, will take effect on July 1st. The New York Tribune, commenting on this change, says that Congress, in directing it, was probably "governed by the obvious fact that meteorological work is essentially civilian, and not military in character." The Tribune urges that great care should be taken in the selection of a new chief. "Congress," it says, "has properly provided that the daring and skilful commander of the Fort Conger Arctic Expedition of 1881-84 shall, after the Signal Corps is relieved of its meteorological duties, retain his present military rank and emolument. No element of personal reproach or hostility has entered into the movement for the transfer, so far as we know. The change thus involves no indignity to that gallant and accomplished officer and popular hero. This is a fortunate phase of the matter, and since several of General Greely's most valued assistants either gain promotion in the re-organized branch of military service in which they intend to remain, or else go with the observers and clerks into the new civil bureau, the President will experience less embarrassment than would otherwise be the case in selecting the new Superintendent."

[We reprint the above from *Nature*, and heartily endorse the opinion of the *Tribune*.—ED.]

THE METEOR OF DECEMBER 14TH.

IN addition to the notes in our February and March numbers, we may mention that the *Essex Naturalist* for October to December, 1890, contains nearly two pages of accounts of it as seen from twelve different places in Essex, and that Colonel Tupman, one of the vice-presidents of the Royal Astronomical Society, is collecting the accounts with a view to computing its path.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, SEPT., 1890.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	75·9	10	37·8	1	70·1	51·3	53·0	80	119·9	37·1	·65	5	4·7
Malta	84·2	14	58·7	25	78·4	65·1	60·7	71	138·6	50·0	1·31	6	2·2
Cape of Good Hope	86·5	4	41·9	11	66·1	48·8	...	...	...	...	2·11	...	5·0
Mauritius	77·6	4	59·2	1, 2	74·6	64·1	58·7	71	131·0	47·6	·45	10	6·4
Calcutta	92·7	5	71·8	27	87·5	76·8	78·2	87	161·4	71·2	12·53	18	6·4
Bombay	86·3	28	72·8	16	84·3	76·2	73·7	81	149·0	69·0	6·45	17	6·6
Ceylon, Colombo	87·0	3	73·3	4	84·9	77·0	80·3	77	152·0	70·0	1·50	19	6·5
Melbourne	74·9	23	35·0	9	62·7	46·6	45·6	73	125·0	28·7	2·36	16	6·9
Adelaide	83·4	26	41·4	8	66·0	50·7	47·6	68	136·7	31·4	1·75	13	5·5
Wellington	67·5	13	36·5	7	59·2	45·6	43·9	74	121·0	29·0	3·95	15	4·4
Auckland	69·0	30	41·5	6	62·2	49·5	46·8	72	133·0	31·0	3·55	17	5·9
Jamaica, Kingston	91·3	27*a*	70·6	13	89·0	72·4	70·9	75	...	...	3·04	...	...
Trinidad	96·0	10	64·0	30	89·0	70·4	71·4	80	160·0	62·0	3·37	16	...
Toronto	79·0	4	35·1	29	66·6	48·6	51·9	78	...	29·0	1·85	10	4·9
New Brunswick, Fredericton	72·8	13	30·0	25	64·8	46·8	51·9	81	...	...	3·72	15	5·5
Manitoba, Winnipeg	82·5	29	27·8	14	61·6	39·1	43·6	77	...	...	3·06	14	4·6
British Columbia, Victoria	...	...	...	...	...	...	...	...	...	...	...	...	...

a And 30th.

REMARKS.

MALTA.—Mean temp. 70°·5; mean hourly velocity of wind, 8·9 miles; sea temp. fell from 82°·6 to 75°·0; Thunderstorms on 4th and 14th; L on 6 days. Temp. much below the average, but fevers very prevalent. J. SCOLES.

Mauritius.—Mean temp of air, 0°·9; mean dew point 1°·0, and rainfall ·96 in. below their respective averages; mean hourly velocity of wind, 10·8 miles, or 1·2 below average; extremes 27·4 on 30th and 1·7 on 10th; prevailing direction, S.E. by E. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 1°·3; of dew point 2°·0; humidity 2; cloud 0·9 and rainfall ·11 in. above their respective averages. Prevailing winds N. and N.W., strong on 6 days; fogs on 3 days; hail on 2 days; hoarfrost on 9th. Thunderstorms on 3 days and L on 3 other days; lunar halo on the 21st. R. L. J. ELLERY, F.R.S.

Adelaide.—The month was warm, the mean temp. being 1°·3 above the average. This result was chiefly due to the warm nights experienced; the mean of the min. readings of the month being 3° above the average. The rainfall of the month was slightly under average amount. C. TODD, F.R.S.

Wellington.—Fine for the first two days, then showery till 6th, with strong Southerly winds with hail on 4th and 5th. Fine from 6th to 15th, then showery until 18th; and again fine until 21st; showers on next three days and fine for the remainder of the month. Prevailing wind, N.W. Mean temp. 1°·5 above the average. R. B. GORE.

Auckland.—Strong N.E. gale from 11th to 14th; light variable winds during the rest of the month; rainfall slightly above the average; mean temp. rather more than a degree over the average. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL, MARCH, 1891.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in			in.
II.	Dorking, Abinger Hall.	2·47	XI.	Rhayader, Nantgwillt..	4·39
,,	Margate, Birchington...	2·69	,,	Corwen, Rhug	2·81
,,	Brighton PrestonvilleRd	2·30	,,	Carnarvon, Cocksidia ...	1·40
,,	Hailsham	2·49	,,	I. of Man, Douglas	1·51
,,	Ryde, Thornbrough	2·15	XII.	Stoneykirk, Ardwell Ho.	2·64
,,	Alton, Ashdell.....	2·92	,,	New Galloway, Glenlee	4·45
III.	Oxford, Magdalen Col...	1·55	,,	Melrose, Abbey Gate ...	3·83
,,	Banbury, Bloxham	1·35	XIII.	N. Esk Res. [Penicuick]	5·65
,,	Northampton	·84	XIV.	Ballantrae, Glendrishaig	2·29
,,	Cambridge, Fulbourne..	1·86	,,	Glasgow, Queen's Park.	2·63
,,	Wisbech, Bank House..	·73	XV.	Islay, Gruinart School..	3·77
IV.	Southend	1·84	XVI.	Dollar.....	*3·13
,,	Harlow, Sheering	1·86	,,	Balquhidder, Stronvar..	5·86
,,	Rendlesham Hall	1·82	,,	Coupar Angus Station..	2·50
,,	Diss	2·06	,,	Dunkeld, Inver Braan..	2·65
,,	Swaffham	1·39	,,	Dalnaspidal H.R.S. ...	5·18
V.	Salisbury, Alderbury...	1·82	XVII.	Keith H.R.S.	2·13
,,	Warminster	2·28	,,	Forres H.R.S.	1·59
,,	Bishop's Cannings	1·83	XVIII.	Fearn, Lower Pitkerrie.	1·19
,,	Ashburton, Holne Vic....	4·89	,,	Loch Shiel, Glenaladale	8·03
,,	Okehampton, Oaklands.	2·42	,,	N. Uist. Loch Maddy ...	2·46
,,	Lynmouth, Glenthorne.	2·19	,,	Invergarry	2·23
,,	Probus, Lamellyn	2·88	,,	Aviemore H.R.S.	3·29
,,	Wincanton, Stowell Rec.	3·60	,,	Loch Ness, Drumnadrochit	2·87
,,	Wells, Westbury.....	2·68	XIX.	Lairg H.R.S.	5·57
VI.	Bristol, Clifton	2·80	,,	Scourie	3·43
,,	Ross, the Graig	1·79	,,	Watten H.R.S.	2·87
,,	Wem, Clive Vicarage ...	1·19	XX.	Dunmanway, Coolkelure	2·59
,,	Cheadle, The Heath Ho.	1·74	,,	Fermoy, Gas Works ...	1·91
,,	Worcester, Diglis Lock	1·37	,,	Darrynane Abbey.....	2·51
,,	Coventry, Coundon	1·28	,,	Tipperary, Henry Street	2·28
VII.	Ketton Hall [Stamford]	1·21	,,	Limerick, Kilcornan ...	1·67
,,	Grantham, Stainby	1·27	,,	Ennis	1·99
,,	Horncastle, Bucknall ...	1·45	,,	Miltown Malbay.....	1·72
,,	Worksop, Hodsock Priory	1·31	XXI.	Gorey, Courtown House	1·05
VIII.	Neston, Hinderton	1·13	,,	Mullingar, Belvedere ...	1·02
,,	Knutsford, Heathside ...	1·80	,,	Athlone, Twyford	1·57
,,	Lancaster, Southfield ...	1·56	,,	Longford, Currygrane...	1·11
,,	Broughton-in-Furness ..	2·81	XXII.	Galway, Queen's Coll...	1·86
IX.	Ripon, Mickley	1·56	,,	Crossmolina, Enniscoe..	3·26
,,	Scarborough, West Bank	2·76	,,	Collooney, Markree Obs.	2·53
,,	East Layton [Darlington]	1·68	,,	Ballinamore, Lawderdale	1·88
,,	Middleton, Mickleton..	2·30	,,	Lough Sheelin, Arley ..	1·41
X.	Haltwhistle, Unthank..	2·66	XXIII.	Warrenpoint	1·00
,,	Bamburgh.....	2·73	,,	Seaforde	1·32
,,	Shap, Copy Hill	...	,,	Belfast, New Barnsley..	2·32
XI.	Llanfrechfa Grange	2·17	,,	Bushmills, Dundarave...	3·50
,,	Llandovery	2·49	,,	Stewartstown	1·83
,,	Castle Malgwyn	·93	,,	Buncrana	4·31
,,	Builth, Llanwrtyd Wells	3·70			

MARCH, 1891.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average. 1880-9.	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date	Min. Deg.	Min. Date	No. of Nights below 32°. In shade.	No. of Nights below 32°. On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·01	+ ·40	·55	9	15	57·7	2	23·7	12	9	22
II.		Maidstone (Hunton Court)...	2·14	+ ·64	·60	10	14	...	...	...	...	...	..
,,		Strathfield Turgiss	2·07	+ ·48	·37	7*b*	14	58·0	5	9·8	12	11	25
III.		Hitchin	1·48	+ ·14	·44	7	18	62·0	1	20·0	12	13	22
,,		Winslow (Addington)	1·20	— ·52	·34	7	16	62·0	1	15·0	12	14	22
IV.		Bury St. Edmunds (Westley)	1·69	+ ·14	·28	7, 9	17	...	...	...	...	...	...
,,		Norwich (Cossey)	1·45	+ ·03	·26	27	19	...	...	...	...	...	...
V.		Weymouth(LangtonHerring)	3·58	+ 1·68	·92	10	15	54·0	5	25·0	12	12	...
,,		Barnstaple	1·11	— 1·38	·22	7, 15	11	58·0	1	25·0	31	...	...
,,		Bodmin (Fore Street)	3·52	— ·26	1·00	9	18	...	...	...	...	...	...
VI.		Stroud (Upfield)	1·50	— ·69	·46	15	16	60·0	1	18·0	11	14	...
,,		ChurchStretton(Woolstaston)	1·34	— ·79	·27	15	21	60·0	1	23·0	12	19	23
,,		Tenbury (Orleton)	1·47	— ·61	·30	15	20	63·1	1	18·2	12	14	19
VII.		Leicester (Barkby)	1·10	— ·61	·20	25	20	65·0	1	15·0	11	17	27
,,		Boston	1·54	·00	·45	8	13	65·0	1	24·0	15	20	...
,,		Hesley Hall [Tickhill].....	1·40	— ·50	·40	7	19	58·0	1	20·0	9	14	...
VIII.		Manchester(PlymouthGrove)	1·59	— ·63	·37	6	13	55·0	1	23·0	11	12	25
IX.		Wetherby (Ribston Hall) ...	1·23	— ·83	·26	26	12	...	...	...	...	...	..
,,		Skipton (Arncliffe)	3·51	— 1·59	·56	23	20	44·0	1	26·0	8	14	...
,,		Hull (PearsonPark)	1·29	— ·76	·20	15	20	...	...	..	...	..	...
X.		Newcastle (Town Moor)	3·51	+ ·88	1·11	7	21	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	8·35	— 2·15	1·43	6	16	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	1·90	— 1·08	·40	15	17	...	...	...	...	...	...
,,		Haverfordwest	1·34	— 1·90	·41	15	15	52·9	26	19·9	11	12	...
,,		Carno (Tybrith)	3·30	— ·24	·67	25	21	48·0	1	13·0	11	24	...
,,		Llandudno.....	1·55	— ·53	·40	15	15	55·0	1, 2	26·4	12	4	...
XII.	SCOTLAND.	Cargen [Dumfries]	2·52	— ·78	·69	7	13	54·2	1	11·0	9	15	...
,,		Jedburgh (Sunnyside).....	3·17	+ 1·21	·92	16	10	55·0	1	10·0	9	17	...
XIV.		Old Cumnock	4·91	+ 1·78	·75	15	17	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	4·94	+ ·48	·91	5	18	...	...	13·0	8	23	...
,,		Oban (Craigvarren)	3·46	...	·57	5	17	51·6	4	19·0	9	11	...
,,		Mull (Quinish).....	4·19	+ ·35	·62	5	16	...	...	...	...	...	...
XVI.		Loch Leven Sluices	3·40	+ ·43	1·30	17	6	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	2·00	— ·40	·95	16	7	56·8	1	19·1	9	15	...
XVII.		Braemar	2·53	— ·11	·53	14	18	55·2	1	13·5	13	26	29
,,		Aberdeen (Cranford)	2·12	...	·55	29	22	48·0	2, 25	21·0	8	18	...
XVIII		Strome Ferry.....	3·74	— ·89	·67	3	16	...	..	...	...	...	...
,,		Inverness (Culloden)	1·05	— ·49	...	..	...	59·0	1	19·0	9	14	30
XIX.		Dunrobin	4·02	+ 1·77	·52	25	18	62·0	1	19·0	9	19	...
,,		S. Ronaldsay (Roeberry).....	2·61	+ ·07	·30	25	24	53·0	1	20·0	27	13	...
XX.	IRELAND.	Dromore Castle	2·90	— 1·52	·52	15	14	58·0	29	25·0	11	...	...
,,		Waterford (Brook Lodge) ...	1·42	— 1·48	·44	14	12	61·0	1	22·5	14	9	...
,,		O'Briensbridge (Ross)	2·39	...	·44	14	13	50·0	5	20·0	11	17	...
XXI.		Carlow (Browne's Hill)	1·11	— 1·26	·31	14	15	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	·94	— 1·07	·22	14	16	57·9	1	27·1	12	10	20
XXII.		Ballinasloe	1·51	— 1·12	·39	14	17	52·0	1	18·0	11*a*	20	...
,,		Clifden (Kylemore)	4·79	...	1·09	31	18	..	...	...	...	...	...
XXIII		Waringstown	1·33	— 1·02	·40	14	20	59·0	1	16·0	13	15	21
,,		Londonderry (Creggan Res.).	3·75	+ 1·02	·52	26	21	...	...	...	...	...	...
,,		Omagh (Edenfel).....	2·35	— ·16	·35	14	22	55·0	1	20·0	9	12	20

a And 13. *b* And 10.

+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON MARCH, 1891.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

HUNTON COURT.—S on 9th and 10th, yielding ·92 in.

STRATHFIELD TURGISS.—The weather of March was stormy and disturbed throughout the entire month, with a low temperature and occasional snow-storms. The min. on the grass on the 12th was 8°·9, and many years have elapsed since we have had so wintry an Easter. All vegetation is extremely backward. First wild primrose on 17th; first wasp seen on 21st. At this station two radiation thermometers are used; one is *always* on grass, the other is placed on the surface of snow whenever it is possible so to do.

HITCHIN.—Heavy S on the 9th.

ADDINGTON.—Many changes of weather occurred during the month. On the first a max. shade temp. of 62°, and on the 10th a max. of 31° only, a heavy S storm raging all day. On the morning of the 12th, intense frost. On the 26th H storms, and one loud peal of T at 3 p.m. During the snow storm of the 10th, there was a great deal of drifting, but it did not cause much inconvenience in this district.

BURY ST. EDMUNDS, WESTLEY.—A cold winterly month, S or H falling in small quantities on ten days; distant T on 26th; vegetation backward.

LANGTON HERRING.—A cold, wet month, the rainfall being the greatest in March for at least 17 years. The great snow storm of the 9th and 10th was very similar to the storm of January, 1881, and though not so much S fell now, as then, the drifts in the roads were higher—in some places here, as much as 14ft. The damage done to evergreen trees and to the hedges was much more serious than in 1881. The ground in general was covered by from 13 to 15 inches of snow, but from the high wind it was not possible to ascertain exactly the amount of fall. The Feb. drought lasted to March 7th—35 days without R.

BODMIN.—A very cold and stormy month. A hurricane from E. on 9th and 10th, with S about 8 inches on 9th and 4 inches on 10th. I could not get to the rain gauge, as there was a drift more than 5 ft. deep in the garden, and the door could not be opened.

STROUD, UPFIELD.—Gale and S at night on the 9th and all day on the 10th, drifting very much. Frost in the morning of the 15th, then heavy R and S in the afternoon. Hail showers and high wind on 26th.

WOOLSTASTON.—After two mild spring days cold weather returned, and the remainder of the month was stormy and very cold; S fell on several days, but never to any depth. There was a wild gale on the night of the 9th and 10th, but the fall of S was quite insignificant; mean temp. 38°·3.

ORLETON.—The first week was very warm and pleasant, the thermometer on the 1st rising to 63°·1. The remainder of the month was bitterly cold, with very hard frosts and much S. A great gale occurred on the night of the 9th inst., with fine drifting S. Most of the R fell in very small quantities, and there was generally a rough wind which dried it up as it fell, so that there was much complaint about the scarcity of water at the end of the month. Temp. 1°·2 below the 30 years average.

LEICESTER, BARKBY.—Excepting the first few days, the month was very cold and bleak, with occasional strong winds and frequent snow storms. Mean max. 47°·8; mean min. 30°·8; mean temp. 39°·3.

HULL, PEARSON PARK.—The weather throughout the month was cold, with frequent, though slight falls of H, sleet or S, squally and often very cloudy.

WALES.

HAVERFORDWEST.—The fine weather of February continued up to the 9th, when the weather assumed a threatening appearance, the wind rising to a furious gale towards evening, with blinding snow, continuing all night; depth 8 to 10 inches, drifts in some localities as many feet, particularly in the southern districts. The S continued falling until 5 p.m. on the 10th, after which the sky cleared and an intense frost set in, the temp. in shade on the morning of the 11th being 19°·9, and on the snow 10°·5. The rest of the month was

cold, mostly fine and frosty. The snow could not be accurately measured, as the fine salt-like character of it caused it to be blown over and out of the funnel. Prevailing winds, E., N., and N.W. This has been the driest three months ending March 31st in the last 42 years, with the exception of January to March, 1858, when 4·38 in. fell.

SCOTLAND.

CARGEN.—Generally speaking, a bright month, 30 hours sunshine above the average. Easterly winds prevailed for 15 days. Mean temp. 2°·5 below the average. S 6½ inches deep on 8th. Lunar halo on 18th. H shower on 25th. S showers on 3rd and 26th.

JEDBURGH.—The weather during the month was most cold and ungenial, virulent cold winds generally prevailing, with comparatively little sunshine; 2 inches of S fell at night on 8th, and 8 inches on 11th. The land is in a dry state, but little corn is yet sown. Vegetation may be said to be stationary. Grass land is as brown as brown paper.

OLD CUMNOCK.—On 6th 1 inch of S fell, on 7th and 8th 4½ inches, on 15th 4 inches, and on 25th 2½ inches.

OBAN.—The month was most stormy, with exceptional frosts from the 7th to 14th, and mean temp. much below the average. In the early part there was a fine cold period, with prolonged calm and sunshine during the blizzard in the South of England. All growth was much checked.

ABERDEEN.—A very cold, stormy month all through.

INVERNESS, CULLODEN.—The month was cold, with continued frost, and a very small rainfall. Vegetation backward.

DUNROBIN.—A cold and stormy month.

S. RONALDSAY, ROEBERRY.—The most severe March for a number of years. Gales on 1st and 15th. Snowstorms on six days.

IRELAND.

DROMORE.—Cold, and showery occasionally. Vegetation at a standstill.

WATERFORD, BROOK LODGE.—Much easterly wind during the early part of the month. Mean temp. 41°·4. S on the Comeragh Mountains on 15th.

O'BRIENSBRIDGE, ROSS.—A very cold but fine agricultural month. N. and N.E. winds were prevalent, with frequent and some very severe frosts.

DUBLIN.—Opening with a long-continued westerly gale, March, 1891, proved very severe, cold and showery. Mean temp. no less than 3° below that of February. Fogs on 4 days. High winds on 13 days. Snow or sleet on 7 days. H on 9 days. Temp. in screen exceeded 50° on 9 days.

BALLINASLOE.—A harsh, cold, and blustering month.

EDENFEL.—The month began fresh and mild, and during the second week was bright, clear, and frosty, but from the 14th to the end there followed a period of polar and easterly winds, not of the usually dry character, but mostly raw, wet, and inclement, with no vegetation whatever.

GREAT TERRESTRIAL RADIATION.

To the Editor of the Meteorological Magazine.

SIR,—I wonder whether you noticed the extraordinary terrestrial radiation on the evenings of 27th and 28th ult. At 5.30 p.m. on 27th I read 50° Fahr. in Stevenson screen and 31° on grass, a difference of 19°, the greatest I ever recorded. At 5.40 p.m. on 28th the readings were 51° and 33°. The shade max. temp. on each of the above-mentioned days was higher than any previous February reading in my 17 years' record. I need hardly add that my thermometers are in perfect order.—Yours faithfully,

WM. B. BUTLER.

Highland House, 235, Camden Road, N. 5th March, 1891.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

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THE THEORY OF HALOS AND PARHELIA.

[It has long appeared to us that a thoroughly accurate and yet clear explanation of the formation of Solar and Lunar Halos, and of Mock Suns and Mock Moons (known also as Parhelia and Paraselene), was needed, and we are much indebted to the Rev. A. K. Cherrill for preparing the paper, which will be completed in our June number. —ED. *M.M.*]

CORRECTION OF A PREVALENT ERROR.

COLOURED rings of small diameter are often seen surrounding the Moon. The innermost circle is generally quite close to the Moon; but the size of the rings is variable, and when they are larger than usual observers have sometimes mistaken them for halos. As it is important that this should be avoided, it will be well to say a few words about these small coloured rings, or coronæ as they are called, and to point out how they differ from the true halos. Coronæ as often surround the Sun as the Moon, though they are then more difficult to discern, being obscured by the brightness of his rays. They are best seen when the reflection of the Sun is observed in still water. These rings were observed and measured by Sir Isaac Newton. A set of two about the Moon had diameters of three and of five and a half degrees, the colours being blue next the Moon and red without. A larger set of three surrounding the Sun had diameters of five, nine, and twelve degrees, the colours being in the same order. Newton explained these rings by the light passing through very minute drops of water, the colours being produced by interference. He found by calculation that if the drops were 1-500th of an inch in diameter, the diameters of the rings would be about seven, ten, and twelve degrees, the rings being larger when the globules are small, and smaller when the globules are larger. These coronæ, then, differ from the true halos in their small and variable size, in the order of the colours, (the halos having the red next the Sun) in never being accompanied by parhelia or paraselene. The cause by which they are produced

is also different. Coronæ are the result of thin watery mists in the lower strata of the atmosphere, while the true halos are attributed to ice crystals floating in the upper regions.

The Ordinary Halo.

A good example of the true halo, which is less common than the coronæ, occurred in the neighbourhood of London on January 29th, 1890, and was described with an illustrative sketch in the *Meteorological Magazine*, vol. xxv., p. 2. The general appearance of a halo of this description is represented in Fig. 1, where H H is the horizon, Z the zenith, and S the position of the Sun. The circle B A C, having the Sun for its centre, is called the halo of 22 degrees, its semi-diameter being an arc of 22 degrees of a great circle of the heavens. It shews prismatic colours, the red being inside, or nearest the Sun, and the violet outside; but the intermediate colours are generally faint, and sometimes disappear altogether, so that the appearance of two separate bands may be presented.*

A similar but larger circle, G E D F K, is known as the halo of 46 degrees, that being its distance from the Sun.

G B S C K is a band of white light passing through the Sun, and is named theparhelic circle. E A F and L D M are prismatic arcs, the upper one having the zenith for its centre, and touching the highest point of the two circles surrounding the Sun.† The colours of these arcs are brighter than those of the circles, and are in the same order reckoning from the Sun, but in the reverse order if we reckon from the centres of the circles. That is to say, the red is always nearest the Sun, and so circles surrounding the Sun have the red on their inner side as in the secondary rainbow, while circles convex to the Sun have the red on their outer side, as in the primary bow.

Parhelia, or Mock Suns.

Mock suns are usually seen at or near the points B and C, where the white band crosses the inner circle, and they may also be seen at the crossing of the outer circle, and at some other points in the parhelic circle.

Sun Pillar.

There is also sometimes seen a vertical band of white light in the direction D A S, which may be prolonged below the Sun. This is not represented in the figure. It is called in the Orkneys a "Sun pillar," and is rarely visible except after sunset, or before sunrise,

In comparing this general description with particular examples of halos, it must be remembered that just as the rainbow is sometimes

* This is probably the appearance described by a correspondent (*Met. Mag.* vol. xx., p. 89), though the distance between the bands not being given, renders it somewhat uncertain.

† Tangent arcs may also occur at other points, but these will not have the zenith for their centre.

seen complete down to the ground, while sometimes only one or two small fragments of it appear, so the circles and arcs of the halo may vary very greatly in completeness, and also in brightness, and some of them may be wholly absent. Another case of variation in appearance is that in the circle turned away from the Sun having the zenith for its centre, the curvature will differ according to the height of the Sun above the horizon. Moreover, when only a small arc of this circle is seen, as is usually the case, it is not easy for the eye to determine its centre; and thus in sketches which are not very carefully made, the arc may be erroneously represented as having some other point than the zenith as its centre. The curvature of the tangent arcs to the halo of 22° also varies with the elevation of the Sun, and in some cases is reversed, so as to form an eclipsed halo surrounding the Sun.

When the white band passing through the Sun is short its curvature will hardly be perceived; and if there is also a perpendicular white band, the appearance of a cross will be presented. On the other hand the horizontal white band, which is parallel to the horizon, and therefore has the zenith for its centre, may be prolonged into a complete circle, and so be seen in the part of the sky opposite the sun; or the part of it opposite the Sun alone may be visible, thus presenting the appearance described and figured as a zenithal halo in *Met. Mag.*, vol. xvi., p. 92; or, again, a small portion of it may be seen at a considerable distance from the Sun. Such may have been the "brilliant patch of pure white light in the north western sky, at a distance of 90° from the western mock sun," which is described as forming one of the most noteworthy features of the halo of January 29th, 1890. Another source of variation is that the tangential arcs, though usually seen touching the highest points of the circumsolar circles, may occur at other points also. A curious halo is figured in *Met. Mag.*, vol. xiii., p. 45. This is a good example of the way in which the appearance may differ from the ordinary type. It may be described as a halo in which only the inner circumsolar circle and two tangent arcs to the outer circle are visible. It is true that the distance between the inner circle and the arcs is rather too small in comparison with the diameter of the circle for this explanation; but as the halo lasted only a short time, and was apparently sketched from memory, this is easily accounted for.

The Theory of Halos.

Let us pass now to the theoretical explanation of these halos. Sir Isaac Newton believed them to be produced by a different cause from the coronæ previously mentioned. He attributed them to "some sort of hail or snow floating in the air in a horizontal position, the refracting angle being about 58 or 60 degrees." Huygens also thought that these appearances were due to floating crystals of ice; but he rendered his theory more complicated by assuming the existence of cylindrical particles of hail having opaque nuclei. The

formation of these cylinders he explained in the following manner:— He supposed particles of snow first to adhere together in a globular form, and to be supported by an ascending current of air. Other particles would then be frozen on to the top or bottom of the mass, the sides being kept clear by the current of air, and a cylindrical form would be thus obtained. Afterwards he supposed these cylinders to be partially thawed, and then again frozen, so as to become transparent ice on the outside, while remaining opaque internally. By means of these supposed cylinders Huygens was able to explain in detail the principal phenomena of halos; but it must be admitted that the account of their formation is too complicated to be at all probable. Fortunately, however, subsequent research has shewn them to be quite unnecessary, and the phenomena have all been satisfactorily accounted for by a return to the simpler hypothesis of Newton.

Dr. Young found that the inner circle of 44 degrees in diameter could be formed by crystals of ice floating in the air, and having refracting angles of 60°. To explain the outer circle 92 degrees in diameter, he supposed that rays which have been refracted by one ice crystal might again fall upon, and be refracted by, a second crystal. This, however, does not appear likely, and a more satisfactory suggestion was made by Cavendish, who supposed the ice crystals to have flat ends forming angles of 90 degrees with their sides, in which case refraction through these rectangular ends would completely account for the outer circle.

This suggestion of Cavendish may be said to complete the main part of the theory of halos; but the subject was further worked out in detail by M. Bravais, a French naval officer, who produced, in the year 1847, an elaborate "Mémoire sur les Halos," which still holds its place as the best exposition of the subject.

The explanation of parhelia and halos thus finally arrived at is optically simple, at least as far as the more ordinary phenomena are concerned; the chief difficulty in understanding it arises from the complicated perspective which it involves.

Suppose an observer to stand facing the Sun. A ray of light, S A, Fig. 2, which, if not intercepted, would have passed over the observer's head, falling upon an ice crystal in a suitable position at A, would be bent downwards to meet the eye, and thus produce an image of the Sun seen in the direction of the crystal, and therefore above the Sun's real position. Another ray, S_2 B, which would have passed still higher over head, would also be brought down to the eye if refracted by the angle of 90° of another crystal at B, and thus produce a second image of the Sun above the first. It is evident, however, that this would take place not only in the vertical plane, but also in all planes passing through the eye and the Sun, provided that crystals presented themselves in the proper position.

If we imagine the plane of Fig. 2 to revolve about the line E S as an axis, the lines E H_1, E H_2, will trace out two cones, having the

eye for their common vertex, and the two circles of the halo for their bases, and any crystal on the surface of these cones will be similarly situated with regard to the eye and the Sun to the two crystals shewn in the figure. In the corresponding explanation of the rainbow this is all that we have to consider. The drops of water being spherical, it is enough if they are in the proper situation, all positions of the drop are the same. But it is otherwise with regard to the crystals we are now considering. They must not only be in the right situation, but also in the right position. Thus the prisms which produce the halo of 22° must have their axes perpendicular to the plane of the figure, that is the plane in which the Sun, the eye, and the crystal are situated; while the crystals producing the halo of 46° must have their axes lying in this plane. The importance of this observation will be apparent when we come to consider the explanation of the parhelia. Crystals thus placed, and being also rotated about their axes into the position producing minimum deviation, will form a series of images of the Sun all at the same distance, and these, by their coalescence, will produce the two circles of the halo. To test the truth of this explanation we must consider how it will account for the constant size of the rings. We will suppose the crystals to be in the position which produces the minimum amount of deviation, which takes place when the ray enters, and emerges at an equal distance from the vertex, and therefore, in the case of an isosceles prism, passes through in a direction parallel with the base. The deviation on leaving the crystal is thus equal to that on entering it, or the total deviation is double that caused by the light entering the crystal. Let C A D be the normal to the surface at the point A. Thus, S_1 A C is the angle of incidence, D A F the angle of refraction, and since A F is parallel to the base of the equilateral prism, D A F must equal 30°. Now the index of refraction of ice being 1·31, we know by the law of refraction that Sin S_1 A C = 1·31 Sin D A F; but Sin 30° = $\frac{1}{2}$, therefore Sin S_1 A C = $\frac{1}{2}$ of 1·31 = ·655, and this will be found by the tables to be the sine of 40° 56′, which is therefore the angle of incidence, and the angle of refraction being, as already stated, 30°, the deviation at the first surface will be 10° 56′, and the total deviation, that is the angle S E F, equals 21° 52′, which gives 43° 44′ as the diameter of the inner circle.

The calculation for the outer circle may be given more briefly as follows:—

Refracting angle	90°
Angle of refraction for minimum deviation...	45°
Sine 45°	= ·7071
Sine of angle of incidence = ·7071 × 1·31	= ·9263
Angle of incidence	= 67° 52′
Deviation at first surface	= 22° 52′
Total deviation	= 45° 44′
Diameter of circle	= 91° 28′

These results, correspond so closely with the observed dimensions of the rings, as to afford a strong confirmation of the theory.

It remains, however, to account for the circular arcs turned away from the Sun, which touch the upper portions of the two rings. Hitherto we have confined our attention to refractions which take place in planes passing through the eye and the Sun. To account for this part of the phenomena we must consider the effect of refractions not wholly in one plane.

It is here that the difficulties of perspective already referred to come in. In the case of the two circles round the Sun, the perspective is exactly the same as in the rainbow, and needs no special explanation. To understand the present more difficult case, let us first alter our point of view. In Fig. 2 the observer is at E and the Sun at S, and in looking at the diagram we face in a direction at right angles to the line E S. In looking at Fig. 3, on the other hand, we are supposed to face in the same direction as the observer at E, and thus to see the line S E foreshortened. S B K E in Fig. 3 is the same line as S_2 B K E in Fig. 2; but, of course, the bendings of the line at B and K cannot in this case be represented. The crystal at B, Fig. 3, has its axis vertical, and one of its sides exactly facing the observer. A ray of light falling on the flat upper end of this crystal will be bent downwards in the way already explained, but it will not be deflected either to the right or left, and will form the upper part of the larger circle. Next suppose another prism at C somewhat to the left of the first, and also with its axis vertical. If the front surface of this prism should be parallel to that of the first, it is clear that the ray refracted by it would pass to the left of the observer and be unperceived by him. But if the face of the crystal should be turned a little away from the observer, then the ray on striking its second surface would be inclined to a vertical plane perpendicular to the face of the crystal, and therefore, according to the laws of refraction, on emerging from the crystal it would be bent not only downwards, but also further away from that plane and towards the eye of the observer. Thus an image would be seen to the left of the former, but at the same apparent elevation, for the deflection in the vertical plane would be the same in each case, and by the coalescence of a number of such images a horizontal band would be produced touching the top of the outer circle. The tangent to the inner circle may be explained in a similar manner, by refraction though the angles of 60°, the axes of the crystal being in this case horizontal.

A question of some interest arises here. Do the tangent circles overlap or coincide with the circumsolar circles at the point of contact, as shewn in Fig. 1? Or are they distinct throughout, touching only at their outer edges, as represented in the figure of the halo of Jan. 29th, 1890, *Met. Mag.*, vol. xxv., p. 2? The circumsolar circles are regarded as being formed by crystals so placed as to give minimum deviation, the upper tangent circle by crystals having their axes

vertical. Now, on referring to Fig. 2, it will be seen that when the crystal at B is so placed as to produce minimum deviation (as there represented), the angle between the line E K and the normal at the point K is equal to the angle of incidence = 67° 52′, and the angle between E K and the horizontal line E L is equal to K E S + S E L = 45° 44′ + the Sun's elevation. Consequently, if the Sun's elevation is 22° 8′, the normal at K and the horizontal line will make equal angles with E K, and will therefore be parallel to each other; or, in other words, the crystal at B in the position of minimum deviation will have its axis vertical, and therefore, in this case, the circles will coincide or overlap where they meet, as shewn in Fig. 1. If, however, the elevation of the Sun is either greater or less than 22 degrees, the vertical crystal will not be in the position of minimum deviation, and will therefore produce a greater deviation, and the tangent circle will be more or less outside the circumsolar halo.

It must be remembered, however, that when a prism is turned out of the position of minimum deviation, the displacement of the image is at first very slight, and therefore for some degrees on both sides of the elevation of 22° the two circles would overlap to a considerable extent.

(To be continued.)

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society was held on Wednesday evening, March 18th, at the Institution of Civil Engineers, 25, Great George-street, Westminster, Dr. C. Theodore Williams, vice-president, in the chair.

Mr. H. Brevitt, Mr. J. Lovel, and Mr. L. G. Oliver, were elected Fellows of the Society.

Mr. G. J. Symons, F.R.S., read a paper entitled "A Contribution to the History of Rain Gauges." It appears that Sir Christopher Wren, in 1663, designed not only the first rain gauge, but also the first recording gauge, although the instrument was not constructed till 1670. The earliest known records of rainfall were made in the following countries:—France, Paris, 1668; England, Townley, in Lancashire, 1677; Switzerland, Zurich, 1708; and Ireland, Londonderry, 1711. Mr. Symons gave a very full account of the various patterns of rain gauges, and in most instances pointed out the merits or defects of each.

Mr. A. W. Clayden, M.A., showed on the screen a number of interesting photographs of clouds, lightning flashes, and other meteorological phenomena.

The meeting was adjourned at 8.30 p.m., in order to allow the Fellows to inspect the Exhibition of Rain Gauges, Evaporation Gauges, and new instruments, which had been arranged in the rooms of the Institution.

Almost every known pattern of rain gauge that has been at all generally used in this country was shown, and it was interesting to compare the old patterns with the new ones. Most of the gauges had funnels 5 or 8 inches in diameter. The Meteorological Office 8 inch gauge is by some regarded as the best gauge for ordinary observers to whom cost is not a primary object, as it has all the good features of the Glaisher and of the Snowdon patterns, and, being of copper, is very durable. In mountainous districts, where the rainfall is heavy, and the gauges can be examined only periodically, gauges capable of holding 40 or 50 inches of rain must be used. Specimens of these gauges, as well as of the rain and snow gauges used in France, Germany, Russia, Switzerland, and the United States, were shown. Some interesting storm gauges and self-recording gauges were also exhibited. The evaporation gauges included several instruments employed for measuring the evaporation from a free surface of water, and others for use with growing plants. Many new instruments were also exhibited, among which were various anemometers, and cameras for meteorological photography. Maps of rainfall over the British Isles and over various parts of the world, as well as numerous photographs of floods, meteorological phenomena, &c., were also on view.

The usual monthly meeting was held on Wednesday, April 15th, at the Institution of Civil Engineers, 25, Great George-street, Westminster; Mr. A. Brewin, Vice-President, in the chair.

Mr. J. Baxendell, Mr. H. Champ, and Mr. S. H. Ridge, B.A., F.R.G.S., were elected Fellows of the Society.

The following papers were read :—

(1.) "Some remarkable features in the winter of 1890-91," by Mr. F. J. Brodie, F.R.Met.Soc. The author points out the peculiarities in the weather which prevailed over the British Isles during the past winter. In addition to the prolonged frost which lasted from the close of November to about January 22nd, he finds that the barometric pressure for the whole winter was about a quarter of an inch above the average; and that when the wind was not absolutely calm, there was an undue prevalence of breezes from some cold quarter. The percentage of wind from the southward did not amount to one half of the average. The number of foggy days in London was twice the average. The rainfall over the greater part of the British Isles was less than half the average. The author says that almost every element in the weather has been influenced to an abnormal degree by the remarkable prevalence of high barometrical pressure, the winter of 1890-91, may therefore be defined as the "anti-cyclonic winter."

(2.) "The Rainfall of February, 1891," by Mr. H. Sowerby Wallis, F. R. Met. Soc. This was an elaborate report of one of the driest months upon record; the mean rainfall over England, excluding the Lake District, being only ·066in., or about one-fortieth

of the average. The paper was of course, chiefly tabular, but the facts were epitomized by a map, showing the relative intensity of the phenomemon in various parts of the British Isles.

(3.) "On the variations of the rainfall at Cherra Poonjee, in the Khasi Hills, Assam," by Mr. H. F. Blanford, F.R.S. Cherra Poonjee (Lat. 25° 17′ N., Lon. 91° 44′ E.) has long been notorious as having a heavier rainfall than any other known place on the globe; the mean annual fall being frequently given as about 600 inches. Mr. Blanford has made a critical examination of the various records of rainfall kept at this place, and has come to the conclusion that the above amount is too high, but that the average annual rainfall is probably a little over 500 inches.

REVIEWS.

Bulletin Annuel de la Commission de Météorologie du Département des Bouches-du-Rhone. Année 1889, 8*me année*. Marseilles: Barlatier et Barthelet, 1890. 4to, 108 pp., map and diagrams.

THE department of Bouches du Rhone is one of those in which Le Verrier's idea of Departmental Meteorology is at last well carried out—we say at last, because, as will be seen above, the present series of bulletins dates back to 1881 only—now, however, all seems well organized. The area of the department is about as much larger than the county of Surrey, as it is smaller than that of Essex. The Commission have in it thirty-six stations, of which five are at lighthouses or ports on the Mediterranean and the rest are well distributed inland.

The barometric values are generally very accordant, but two—Port de Bouc and Planier—are wrong, the former about 5$^{mm.}$ too high, the latter about 4$^{mm.}$ too low. This station of Planier—at the lighthouse on the Isle de Planier, a few miles outside of the harbour of Marseilles—seems to us to need the supervision of the Commission. Lighthouses, as we all know, are rarely in situations suitable for rain gauges, and this volume does not state the height of the rain gauges above the soil, but with rainfall totals at the other coast stations all ranging between 24 and 28 inches, we cannot accept 15 inches at La Ciotat, or still less 12·44 inches at Planier. As regards the inland stations, the records generally seem very good, but those for Meyrargues are incomprehensible; surely they are the records for another year?

The volume contains a very clear map of the Department, with the stations plainly marked. Our French friends are so skilled at map work that we believe they could, without sacrificing the clearness of the map, indicate by light shading the orography of the Department; by so doing they would confer a further benefit on the readers of their volumes.

We are sorry to see that the Commission have not yet given up

the old plan of beginning the year with December. They will have to make the change eventually, and the sooner they fall in with the practice of the greater part of Europe, the better for everybody.

We must not omit to notice two important Memoirs which are given in the Appendix—one by M. Stephan, Director of Marseilles Observatory, on the climate of that city, with a diagram showing on the average of the twenty years 1867—86, the mean, and the mean max. and mean min. temperature of every day in the year; and a paper by Dr. Mireur on the relation of climate to disease, illustrated by a series of inexpensive but very effective diagrams.

Meteorological Observations made at the Adelaide Observatory and other places in South Australia and the Northern Territory, during 1883 *and* 1888, *under the direction of* C. TODD, C.M.G., F.R.S. 2 vols. Fcap. folio. Adelaide, 1889, 1890.

WE are very glad to find that the South Australian Government has enabled Mr. Todd to resume the publication of his useful volumes, and trust that it will not be long before he is able to give us the years 1884—1887, for which we are still waiting.

Mr. Todd has done, and is doing, excellent work in South Australia, and his volumes are such as need not fear comparison with those of any observatory in the old country. For instance, Greenwich has recently advanced so far as to give us the readings *in extenso* of thermometers on a Stevenson screen in addition to those on the Greenwich stand; but this Adelaide volume gives us four sets:—(1) the old Adelaide stand, (2) a Greenwich stand, (3) a Stevenson, (4) a *thermomètre fronde*. And it not merely gives the records and an analysis of them, but it gives as a frontispiece to the volume a view of the grounds showing the stands *in situ*. We should expect an earthquake at least if Greenwich condescended to give a picture.

Still even Adelaide might, we think, do better in one or two little points. In the 1883 volume Mr. Todd says that at the observatory they had three rain gauges, two at 1ft. above ground and one at 2ft., but "*the adopted rainfall during the day*, given in the monthly tables, *is the greatest quantity collected in any one of the three gauges.*" Why? We fail to see any reason for this. Suppose instead of three gauges he had thirty, would he still pick out the highest reading? If so, then the magnitude of the record is merely dependent on the number of rain gauges which one has. We have heard persons contend that a rain gauge cannot catch too much, and so try to justify their practice of doing as Mr. Todd has done. We have no doubt that upon consideration Mr. Todd will agree with us that the British plan of keeping the record of each gauge separately is by far the best.

We are very glad to see that a Beckley Recording Rain Gauge has lately been added to the instruments at the observatory, and we hope that funds will allow a few of the important curves each year being reproduced in the annual volumes.

THE COLDEST MONTH.

To the Editor of the Meteorological Magazine.

SIR,—Having seen Mr. King's statement of the mean temperatures of all the Januaries and Decembers from 1872 to 1890 inclusive, at Elswick Lodge, Garstang, Lancashire, I take the liberty of sending you a similar statement for the same period, of the temperatures here, from which you will observe that at no period since the end of 1880, has the average temperature of all the previous Januaries equalled those of the Decembers, but as the difference at the end of the 19 years is only 0°·01, it would take a longer period than 19 years of comparison to ascertain which is the coldest month. By making a similar statement beginning with Dec. 1872 and Jan. 1873, and ending with Dec. 1890 and Jan 1891, the result would be that the Januaries are colder than the Decembers by an average of 0°·38, instead of only 0°·01. This statement includes Dec. 1890, the coldest of the Decembers, but does not include Jan. 1891, 34°·45, 7°·05 colder than Jan. 1872.

Yours truly,
CLEMENT H. GOSSET.

Langton Herring, Weymouth, April 22nd, 1891.

Comparison of the Mean Temperatures of all the Januaries and Decembers from 1872 *to* 1890, *inclusive, at Langton Herring, Weymouth.*

	JANUARY. Mean of each Year.	JANUARY. Average Mean.	DECEMBER. Mean of each Year.	DECEMBER. Average Mean.	Average Mean of January as compared to that of December.
1872	41·50	41·50	43·70	43·70	— 2·20
3	42·38	41·95	42·60	43·15	— 1·20
4	43·35	42·43	34·60	40·30	+ 2·13
5	44·14	42·85	38·80	39·92	+ 2·93
6	37·77	41·84	44·26	40·80	+ 1·04
7	44·26	42·25	40·90	40·82	+ 1·43
8	41·00	42·07	33·45	39·77	+ 2·30
9	32·77	40·91	33·36	38·97	+ 1·94
1880	33·61	40·01	44·48	39·59	+ ·42
1	29·90	39·08	41·54	39·78	— ·70
2	41·45	39·29	41·26	39·92	— ·63
3	41·64	39·48	40·90	40·00	— ·52
4	44·00	39·98	41·19	40·09	— ·11
5	37·68	39·68	39·39	40·04	— ·36
6	36·80	39·49	38·02	39·90	— ·41
7	36·97	39·33	38·32	39·81	— ·58
8	37·86	39·24	42·55	39·96	— ·72
9	38·35	39·19	38·97	39·91	— ·72
1890	43·58	39·42	30·97	39 43	— ·01

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, OCT., 1890.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp.	Minimum. Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	68·5	4	23·8	28	57·9	42·4	43·3	80	109·4	16·8	1·20	13	5·3
Malta	83·2	8	52·6	31	74·8	61·8	58·8	80	141·2	46·0	5·31	11	3·8
Cape of Good Hope	88·2	17	41·8	7	69·5	53·2	...	...	...	...	1·48	...	5·0
Mauritius	79·0	15*a*	54·3	1	76·8	65·6	62·5	77·3	131·5	46·3	1·25	15	6·2
Calcutta	89·7	3	66·9	27	84·6	73·2	74·2	85	153·0	60·5	8·54	11	3·9
Bombay	92·0	30	71·8	31	86·6	75·6	73·2	78	140·8	57·7	·58	3	2·5
Ceylon, Colombo	87·7	25	71·8	26	84·7	75·2	71·5	80	150·0	68·0	13·33	20	7·0
Melbourne	76·0	4, 7	42·6	2	65·5	48·5	45·0	66	130·4	33·0	1·99	19	6·9
Adelaide	83·8	4	41·8	17	68·9	50·3	47·8	65	144·0	33·1	2·54	20	5·0
Wellington	67·3	14	42·0	17	62·6	49·6	46·3	70	125·0	35·0	4·67	14	3·1
Auckland	75·0	11	48·0	21	65·9	52·4	50·5	74	133·0	38·0	10·21	20	6·6
Jamaica, Kingston	92·5	7	70·2	18	88·3	72·5	70·6	73	...	...	2·41	...	...
Trinidad	90·2	4	68·0	12	86·8	70·6	71·7	82	156·0	60·0	10·98	25	...
Toronto	69·9	4	29·0	30	54·7	42·4	43·7	82	...	21·5	4·94	19	7·6
New Brunswick, Fredericton	75·3	2	21·9	23	52·6	34·7	38·0	77	...	...	2·13	13	6·0
Manitoba, Winnipeg	77·5	1	26·0	26*b*	49·5	33·7	37·8	85	...	...	3·68	15	7·4
British Columbia, Esquimalt	59·6	2	35·8	10	53·2	42·5	45·5	91	...	...	5·28	22	7·2

a And 16, 17, 23. *b* And 29.

OCTOBER REMARKS.

MALTA.—Mean temp. 66°·5; mean hourly velocity of wind, 8·7 miles; sea temp. fell from 75°·0 to 70°·5. TSS on 6 days; L on 10th and 24th; H on 24th. J. SCOLES.

Mauritius.—Mean temp of air, 1°0 below; dew point 1°·0 above, and rainfall ·61in. below, their respective averages; mean hourly velocity of wind, 9·2 miles, or 2·4 below average; extremes 21·9 on 19th and 0·0 on 16th; prevailing direction, E.S.E. to E. Fine fore and after glows occasionally. C. MELDRUM, F.R.S.

Colombo.—TSS occured on the 18th and 19th; L alone was seen on the 23rd and 24th. J. C. H. CLARKE, Lieut.-Col., R.E.

Melbourne.—Mean temp. of air 0°·1; of dew point 1°·3; humidity 4; and rainfall ·82 in. below their respective averages. Cloud 0·9 above the average. Prevailing winds N. and N.W., strong on 9 days; fierce squalls from N.W. on 24th; T and L on 3 days; H on 15th; heavy dew on 1st and 10th. R. L. J. ELLERY, F.R.S.

Adelaide.—R ·74in. above and mean temp. 2°·3 below the average of 33 years. Strong winds on 14 days, and gales on 2 days. C. TODD, F.R.S.

Wellington.—Fine generally, with light showers in the early part of the month; showery during the middle and end. Prevailing winds, N.W., generally strong; H on 26th. Mean temp. 2°·5 above the average. R. B. GORE.

Auckland.—An exceedingly wet and stormy month, the rainfall being the heaviest ever recorded for October, and more than three times the average (3·17in.) of 23 years. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL, APRIL, 1891.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in			in.
II.	Dorking, Abinger Hall.	·85	XI.	Builth, Llanwrtyd Wells	3·55
,,	Margate, Birchington...	·29	,,	Rhayader, Nantgwillt..	3·91
,,	Brighton PrestonvilleRd	·66	,,	Corwen, Rhug	2·99
,,	Hailsham	·59	,,	Carnarvon, Cocksidia ...	2·42
,,	Ryde, Thornbrough	·80	,,	I. of Man, Douglas	2·56
,,	Alton, Ashdell.....	·95	XII.	Stoneykirk, Ardwell Ho.	2·60
III.	Oxford, Magdalen Col...	1·41	,,	New Galloway, Glenlee	1·98
,,	Banbury, Bloxham	·81	,,	Melrose, Abbey Gate ...	·61
,,	Northampton	1·94	XIII.	N. Esk Res. [Penicuick]	1·05
,,	Cambridge, Fulbourne..	1·10	XIV.	Ballantrae, Glendrishaig	3·31
,,	Wisbech, Bank House..	·79	,,	Glasgow, Queen's Park.	·81
IV.	Southend	·42	XV.	Islay, Gruinart School..	1·33
,,	Harlow, Sheering	·70	XVI.	Dollar.....	1·19
,,	Rendlesham Hall	·91	,,	Balquhidder, Stronvar..	2·91
,,	Diss	·94	,,	Coupar Angus Station..	2·27
,,	Swaffham	1·01	,,	Dunkeld, Inver Braan..	2·26
V.	Salisbury, Alderbury...	1·03	,,	Dalnaspidal H.R.S. ...	2·44
,,	Warminster	1·15	XVII.	Keith H.R.S.	·87
,,	Bishop's Cannings	1·49	,,	Forres H.R.S.	·21
,,	Ashburton, Holne Vic....	2·82	XVIII.	Fearn, Lower Pitkerrie.	·37
,,	Okehampton, Oaklands.	2·78	,,	Loch Shiel, Glenaladale	2·09
,,	Lynmouth, Glenthorne.	2·07	,,	N. Uist. Loch Maddy ...	·45
,,	Probus, Lamellyn	1·90	,,	Invergarry	1·26
	Launceston, S. Petherwin	...	,,	Aviemore H.R.S.	·80
,,	Wincanton, Stowell Rec.	·73	,,	Loch Ness, Drumnadrochit	·73
,,	Wells, Westbury.....	1·23	XIX.	Lairg H.R.S.	...
VI.	Bristol, Clifton	1·23	,,	Scourie	·61
,,	Ross, the Graig	1·53	,,	Watten H.R.S.	·58
,,	Wem, Clive Vicarage ...	2·50	XX.	Dunmanway, Coolkelure	3·75
,,	Cheadle, The Heath Ho.	2·60	,,	Fermoy, Gas Works ...	1·66
,,	Worcester, Diglis Lock	1·29	,,	Darrynane Abbey.....	3·28
,,	Coventry, Coundon	2·59	,,	Tipperary, Henry Street	1·40
VII.	Ketton Hall [Stamford]	1·11	,,	Limerick, Kilcornan ...	2·22
,,	Grantham, Stainby	1·72	,,	Ennis	2·38
,,	Horncastle, Bucknall ...	1·20	,,	Miltown Malbay.....	1·64
,,	Worksop, Hodsock Priory	1·39	XXI.	Gorey, Courtown House	1·89
VIII.	Neston, Hinderton	1·72	,,	Mullingar, Belvedere ...	2·72
,,	Knutsford, Heathside ...	2·16	,,	Athlone, Twyford	3·32
,,	Lancaster, Southfield ...	1·95	,,	Longford, Currygrane...	3·64
,,	Broughton-in-Furness ..	3·37	XXII.	Galway, Queen's Coll...	2·21
IX.	Ripon, Mickley	3·25	,,	Crossmolina, Enniscoe..	2·05
,,	Scarborough, West Bank	1·75	,,	Collooney, Markree Obs.	1·92
,,	East Layton [Darlington]	4·40	,,	Ballinamore, Lawderdale	3·43
,,	Middleton, Mickleton..	2·51	,,	Lough Sheelin, Arley ..	2·60
X.	Haltwhistle, Unthank..	1·33	XXIII.	Warrenpoint	3·45
,,	Bamburgh	1·08	,,	Seaforde	4·12
,,	Shap, Copy Hill	...	,,	Belfast, New Barnsley..	2·79
XI.	Llanfrechfa Grange	2·49	,,	Bushmills, Dundarave...	·82
,,	Llandovery	3·04	,,	Stewartstown	3·16
,,	Castle Malgwyn	2·18	,,	Buncrana	2·04

APRIL, 1891.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date	No. of Nights below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·13	— ·61	·46	4	9	66·3	28	28·1	1	3	1
II.		Maidstone (Hunton Court)...	·53	— 1·12	·25	4	4	...	...	...	...	...	...
,,		Strathfield Turgiss	1·09	— ·51	·35	4	12	66·6	28	25·5	1	8	18
III.		Hitchin	·84	— ·95	·27	4	11	63·0	30	25·0	26	8	...
,,		Winslow (Addington)	1·28	— ·64	·88	4	13	64·0	28	22·0	1	9	19
IV.		Bury St. Edmunds (Westley)	·64	— 1·02	·15	4	12	...	...	...	...	...	...
,,		Norwich (Cossey)	1·06	— ·65	·30	4	15	60·0	29	23·0	1, 19	1	12
V.		Weymouth(LangtonHerring)	·72	— 1·16	·21	2	10	59·0	27	31·0	1, 8	2	...
,,		Barnstaple	1·50	— ·68	·37	4	11	67·0	6	30·0	25	...	...
,,		Bodmin (Fore Street)	2·69	— ·38	·42	4	12	...	...	...	...	...	...
VI.		Stroud (Upfield)	1·30	— ·85	·25	4	13	65·0	29	32·0	7, 11	2	...
,,		ChurchStretton(Woolstaston)	2·45	+ ·11	·50	21	16	62·0	30	28·5	1	6	14
,,		Tenbury (Orleton)	2·00	— ·08	·42	21	14	65·6	30	24·0	1	7	12
VII.		Leicester (Barkby)	2·07	— ·03	·70	4	13	67·0	30	22·0	26	12	20
,,		Boston	1·11	— ·60	·50	5	11	65·0	26	27·0	18	10	...
,,		Hesley Hall [Tickhill].....	1·25	— ·46	·47	4	14	65·0	30	22·0	1	14	...
VIII.		Manchester(PlymouthGrove)	1·86	+ ·15	·32	29	12	60·0	30	30·0	17	4	20
IX.		Wetherby (Ribston Hall) ...	2·15	+ ·30	·81	5	10	...	...	...	...	...	...
,,		Skipton (Arncliffe)	2·64	— ·79	·43	29	17	57·0	30	27·0	13	10	...
,,		Hull (PearsonPark)	1·82	— ·10	·65	5	15	...	...	..	...	..	...
X.		Newcastle (Town Moor)	1·79	— ·04	·57	5	16	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	7·63	+ ·49	2·10	3	15	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	...	...	...	...	...	...	...	...	...	...	...
,,		Haverfordwest	2·86	+ ·23	·85	2	10	58·8	28	27·0	1	5	8
,,		Carno (Tybrith)	3·63	+ 1·08	·88	3	13	53·0	27	21·0	11	23	...
,,		Llandudno.....	1·42	— ·39	·30	5	11	58·0	30	31·0	1	1	...
XII.	SCOTLAND.	Cargen [Dumfries]	1·94	— ·29	·91	3	9	56·8	30	24·6	1	10	...
,,		Jedburgh (Sunnyside).....	1·05	— ·65	·34	29	7	55·0	15	21·0	1	10	...
XIV.		Old Cumnock	1·41	— ·72	·26	4	12	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	1·50	— 1·31	·38	30	10	...	...	...	...	...	...
,,		Oban (Craigvarren)	1·33	...	·41	30	10	55·9	23	28·4	8	2	...
,,		Mull (Quinish).....	1·46	— 1·52	·50	30	8	...	...	...	...	...	...
XVI.		Loch Leven Sluices	·90	— 1·32	·30	6	7	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	1·30	— ·75	·35	5	10	61·0	30	27·8	1	4	...
XVII.		Braemar	1·63	— ·79	·32	3	10	54·2	30	17·0	1	18	29
,,		Aberdeen (Cranford)	·63	...	·20	20	15	62·0	30	29·0	19	5	..
XVIII		Strome Ferry.....	1·34	— 1·58	·29	30	8	...	..	...	...	...	..
,,		Inverness (Culloden)	·50	— ·54	...	...	...	57·0	30	26·0	1, 8	9	29
XIX.		Dunrobin	·54	— 1·19	·20	15	6	53·5	30	30·0	24	2	..
,,		S. Ronaldsay (Roeberry).....	·72	— ·89	·22	30	13	55·0	30	31·0	2, 28	4	..
XX.	IRELAND.	Dromore Castle	2·47	— 1·14	·44	1	11	62·0	24	31·0	8, 26	2	...
,,		Waterford (Brook Lodge) ...	2·35	— ·12	·52	3	10	61·0	29	30·0	10	3	..
,,		O'Briensbridge (Ross)	2·16	...	·85	3	10	62·0	30	32·0	8, 26	2	...
XXI.		Carlow (Browne's Hill)	1·62	— ·66	·37	1	13	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	1·55	— ·57	·48	3	14	65·7	30	33·1	10	0	12
XXII.		Ballinasloe	2·61	+ ·27	·79	3	14	58·0	30	26·0	8	8	...
,,		Clifden (Kylemore)	3·64	...	1·12	12	16	..	...	...	...	...	...
XXIII		Waringstown	2·74	+ ·32	1·09	1	14	63·0	30	26·0	25	13	22
,,		Londonderry (Creggan Res.).	1·48	— ·76	·39	30	15	...	...	...	...	...	...
,,		Omagh (Edenfel)	2·42	+ ·19	·70	3	14	55·0	18*a*	...	..	4	15

a And 26, 30.

+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON APRIL, 1891.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—With the exception of the first week, a dry month, and at times very cold, but with a rapid rise in temperature on the 30th, and much wind, Solar halo on the 2nd.

ADDINGTON.—Another month of little rainfall; the greater part of it fell in a very short time after five o'clock on the afternoon of the 4th, causing the brook to overflow its banks. The R for the past six months, 7·29 in., is unusually little; all through the month the nights were cold and often frosty, keeping vegetation of all kinds much in check.

BURY ST. EDMUNDS, WESTLEY.—Very cold, with sharp frosts for the time of year, till the last three days of the month; 18 days of northerly wind. In spite of the cold, summer birds returned at their usual time.

LANGTON HERRING.—A fine, dry, but cold month, with the smallest R for April during 20 years. The mean temp. was 2°·2 below the average of 19 years. Solar halos on 1st, 21st and 26th. Fogs on 6th, 29th and 30th.

BODMIN.—A cold month, not seasonable. Very rough night on the 30th.

STROUD, UPFIELD.—Season very backward, owing to cold winds and low temperature. Great promise of fruit in the orchards.

WOOLSTASTON.—A cold backward month, with a good deal of frost. S fell 1st and 7th; T on 5th and T and H on 6th. Mean temp 42°·5.

ORLETON.—A very cold, cheerless month; mean temp. more than 4° below the average of 30 years, and with two exceptions (1879 and 1888), the lowest in April since 1860. Maximum at or above 60° on the last four days only; T on the 6th.

LEICESTER, BARKBY.—Cold and dry till the last few days. R still very deficient, and the water supply at Leicester nearly collapsed during the month.

HESLEY HALL.—Vegetation of all kinds very backward. R much needed; fields all bare, scarcely a bit of anything for the stock to eat; cold cutting N. and N.E. winds prevailing all the month.

MANCHESTER, PLYMOUTH GROVE.—The temp. was the lowest in April for 23 years, excepting 1879, when it was the same. Mean. temp. 44°; S and Sleet on the 2nd and 8th, and thick fog on 14th and 18th. Upon the whole a fine month.

HULL, PEARSON PARK.—The weather during the month was generaly cold, E. or N.E. winds prevailing. The afternoons and evenings were much less cloudy than the mornings.

WALES.

HAVERFORDWEST.—Seasonable wet weather prevailed during the first six days, after which the weather became very fine, with much bright sunshine. Cold generally, with sharp ground frosts during the last fortnight, with prevailing winds from N. and N.E. The month ended wet. Temp. below the mean.

SCOTLAND.

CARGEN.—A very cold month; the mean temp. 42°·1, being the lowest recorded, with the exception of 1887, when the mean was 41°·2. Easterly winds prevailed for 22 days. Only ·08 in. of R fell between the 5th and 29th. The R for the first four months of the year has been only 8·12 in. while the average for the period is 14 in., and the want of water is felt in some parts of the district. All vegetation exceedingly backward. Sunshine 21 hours below the average. T on 30th.

JEDBURGH.—The general character of the weather was cold and ungenial, with little sunshine and much cold wind. There was little vegetation, and from the total want of grass, stock has suffered much. All cereal crops have been got in well, for which the dry state of the ground has been favourable.

OBAN.—A very dry month, with a large amount of sunshine, and much cold wind. Growth much retarded, and sheep suffering for want of pasture.

INVERNESS, CULLODEN.—A very dry month. Temp. below the average, and all pasture very late.

S. RONALDSAY, ROEBERRY.—A very fine month, rainfall much below the average.

IRELAND.

WATERFORD, BROOK LODGE.—A good deal of east wind. Mean temp. 45°·2. Lunar Halo on 16th.

O'BRIENSBRIDGE, ROSS.—A beneficial fall of R occurred on the first four days, after which cold N.E. winds prevailed for most of the month.

DUBLIN.—Cold, rather dry and March-like. Mean temp., rainfall and rainy days, all below the average. On only one day did the temp. rise above 60° in the shade. No S or sleet, but H fell on 1st and 7th.

BALLINASLOE.—A very harsh and cold month, with strong E. and N.E. winds up to the 29th. No vegetation.

EDENFEL.—An ungenial month throughout; raw and cold when wet, harsh when dry. Easterly winds on 22 days. Hardly any vegetation. Hedges brown to the close. The smallness of the rainfall since January 1st (7·45 in.) has only been approached in 27 years, by 1875 and 1879, years also deficient in temp. till May, when the former changed for the better and became an abundant year, but the latter maintained its disastrous character to its close; so we can deduce nothing from the similarity.

THE GREAT SNOWSTORM OF MARCH, 1891.

WE have three facts, or groups of facts to add to the article in our last:—

(1). A very interesting popular shilling book has been published by Simpkin's, entitled, "The Blizzard in the West, March, 1891," with many illustrations from photographs.

(2). Another death from exposure occurred at Chelsham, near Croydon.

(3). We are able to extend our list of snow equivalents.

		Depth, Snow.	Water.	Ratio.
Crowborough Obs., Sussex...	C. L. Prince	6·00 ...	1.30 ..	5 : 1
Camden Sq., Middlesex.....	G. J. Symons.....	5·00 ...	·55 ...	9 : 1
Edith Rd., Kensington	G. von U. Searle	5·00 ...	·45 ...	11 : 1
Parkstone, Poole, Dorset ...	R. H. Barnes.....	4·00 ...	·37 ...	11 : 1
,, ,, ,, ...	,, ,,	6·00 ...	·49 ..	12 : 1
Llavihangel, Monmouth.....	Col. Sturt	10·00 ...	·83 ...	12 : 1
York	J. E. Clark.....	5·00 ..	·31 ...	16 : 1
Bridgewater	H. Corder	6·00 ...	·33 ...	18 : 1

The mean being 11·8 : 1, or say 12 : 1, *i.e.*, just about the average.

MERLE'S MS., 1337-1344.

IT will probably be of interest to state that a sufficient number of subscribers has been obtained to justify publication, that the translation is finished and printed. As there has been some difficulty in the photographic reproduction, the order for printing will not go until May 20th, so that additional names can be received up to that date. The volume will be a very thin folio—about 15 inches by 10 inches—the photographs themselves being about 11 inches by 7 inches.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCCV.] JUNE, 1891. [PRICE FOURPENCE, *or 5s. per ann. post free.*

A CHANGEABLE MAY.

THE engraving, for which we are indebted to the courtesy of our contemporary the *Journal of Horticulture*, represents a May snow scene in Northamptonshire—of equal interest to horticulturists, naturalists and meteorologists; and the most remarkable feature was that this snow-storm followed within less than five days a hot spell, in which the max. had for two days been within a few tenths of a degree of 80° in the shade, and in some places even above 80°. At Camden Square the shade max., on May 13th, was 80°·2, and the shade min. at 5 a.m., on the 17th, 30°·7—a fall of 49°·5 in less than four days.

The facts as to temperature may be thus briefly summarized :—

Sudden rise from min. on the 11th to max. of same day, especially noticeable at London, where it rose 29°·1—viz., from 47°·0 to 76°·1.

Max. of 12th still higher; 79°·7 in London; 75° or upwards at Oxford, Cambridge, York and Loughborough, reaching 81° at the last-named station.

On 13th max. in London still higher, 80°·2; and 75° was reached or surpassed at Hurst Castle, Oxford, Cambridge, Loughborough and York.

Within three days the max. had fallen 30°, or to below 50°, and on the morning of the fourth day, frost had occurred over the greater part of England and Scotland.

Besides the statements made in the Notes on the Month by our regular correspondents, on p. 79, we give a few typical extracts from letters with which we have been favoured, and arrange them in the usual order, except that we give precedence to the note which Mr. Gregory sent to the *Journal of Horticulture* along with the photograph which that journal so excellently reproduced. It is not everyone who is so sharp as Mr. Gregory at 4 a.m. on a snowy morning :—

HAZELBEACH HALL, NORTHAMPTON.—"The enclosed photograph, taken by myself at a quarter past four on Monday morning, May 18th, will give you an idea of a memorable storm. The Friday pre-

ceding was very stormy. "On Saturday we had bright sun. Snow fell about 4 p.m., and covered the ground. Later in the evening the ground and shrubs were covered thickly. Sunday was very stormy, hail, rain, and snow fell frequently during the day; at noon heavy thunder with vivid flashes of lightning prevailed. During the evening snow again fell very heavily, and continued during the whole night and until about 6 a.m. on Monday morning (Whit Monday). Trees, shrubs, and fruit trees, the latter in full bloom, were laid flat upon the ground with their burden of snow, tall trees in leaf had branches broken off, hyacinths and tulips were broken down, but violas were none the worse for the covering. Damsons that were in full bloom are casting off their blossom. We have a row of fine clumps of pæonies 140 yards long, with from fifty to seventy buds upon each clump, which suffered the worst with the weight of snow."—*J. Gregory.*

EASTON MAUDIT, NORTHAMPTON.—

May 10. Exceedingly raw, gloomy day
„ 11. Rapid change to
„ 12. Extreme heat.
„ 13. „ „
„ 14. Cooling down.
„ 15. „ „ rain at night.

The wind all this time ranging from N.W. to N.E. and generally nearly N.

		Minima. Shade.	Maxima. Shade	Rain.
May	10	...	48·5	·08
„	11	46·0	65·0	—
„	12	39·0	75·0	—
„	13	49·0	76·0	—
„	14	49·5	69·0	—
„	15	36·5	58·5	·24
„	16	34·5	49·5	·01
„	17	28·0	53·5	·68
„	18	31·0	46·5	·01

„ 16. Cold and raw; a few slight showers, distinct snow flakes at 2 p.m., sky clearing in evening with every promise of frost, too much verified by minima of 28° in shade, 23° on grass!

May 17. Bright morning, but clouded over about 11; smart showers of rain at 11.30 and onwards; hail enough nearly to whiten the ground at 1.15 p.m.; more showers all afternoon, large drops, and with them large half-sodden snow-flakes, falling vertically and fast; wind dropped; rainfall up to 6 p.m., ·14 in.; more rain, now nearly continuous, which by 9.30 p.m. was largely mingled with straight-falling, sodden snow-flakes, going on I suppose all night.

May 18. At 4.30 a.m. I got up, and it was snowing fast—big, light flakes, no rain, apparently not thawing. Roads and paths clear; lawn deeply covered with snow, trees heavily laden, every twig carrying a good deal. At 7.15 a.m. it was thawing, masses of snow falling from trees; shrubs bowed to the ground under the weight. On lawn, on tops of wooden doors, on mat-covered garden frames, snow everywhere from 2½ to 3 inches deep, singularly uniform, though now sodden and consolidated. The snow was ceasing to fall; the grass thermometer, covered by snow, showed 32° minimum; a few drops of rain fell from time to time during the day, and the sun shone feebly in afternoon, brightly in late evening. Snow melted uniformly, and was nearly gone at noon from lawn, &c. Sky cleared entirely at night, grass white with frost at 5 a.m. (19th); minima, 30° in shade, 24° on grass.—*H. A. Boys.*

COVINGTON RECTORY, KIMBOLTON.—Hail and snow at intervals all the 17th; at 11 p.m. it was still snowing heavily and was over an inch deep on the lawn, and all trees and bushes were weighed down by it as in mid-winter. A nightingale singing merrily in a snow-covered tree.—*A. E. Watson, F.R.Met.Soc.*

THE ROOKERY, BLOFIELD, NORWICH.—On Saturday, the 16th, the thermometer did not rise above 47°, and the day was most winterly, with frequent storms of hail and sleet. An exceptionally heavy hailstorm occurred at 8.50 a.m., and at 9 o'clock ·22 was gauged. This ·22 included some slight showers of the previous evening. Dry bulb 9 a.m. 37°·2! On Sunday morning (17th) I chanced to wake at 3·30 a.m., and looking out, found the whole landscape in the garb of midwinter. Not only was my garden and lawn covered with over two inches of snow, but all the fields, as far as the eye could reach, were perfectly white. The oaks and ashes here were still leafless, and they were covered with as thick a coating of snow as on any day during the recent severe winter. The horse-chesnuts and beeches in their full spring foliage were perfectly weighed down with the weight of the snow. At 9 a.m. the snow had not all disappeared, and I found the min. thermometer had fallen to 29°·8 in the screen, and to 21°·5 on the grass. Dry bulb, 42°·0; wet bulb, 40°·0; rain during past 24 hours, ·25 in. During the morning the thermometer rose to 49°·8; but at 2 p.m., during a hail-storm, fell to 37°·4! On Monday morning (18th), at 6 a.m., the ground was again covered by a deep snow, which laid on the ground till 1 p.m., and in the roadsides till 6 p.m. At 9 a.m. I found the min. in the screen 32°, and on the grass 30°·2. Dry bulb and wet bulb both 36°·2! Rainfall during the past 24 hours ·87 in. Rain, sleet and snow fell continuously till 4 p.m.; ·15 in. falling between 9 and 4, or 1·02 inches between 9 a.m. on the 17th and 4 p.m. on the 18th. As the bulk of this was snow, there is no doubt that had it not thawed as quickly as it did, it would have lain a foot deep on the level. Temperature by 1 p.m. had only risen to 40°; by 4 p.m. to 41°, and by 6.30 p.m. to 42°, which, so far, is the max. for the day. I fear that the results will be disastrous to the fruit crop, which promised to be an unusually good one.—*Arthur W. Preston, F.R.Met.Soc.*

LYNGATE COTTAGE, WORSTEAD, NORWICH.—Three inches of snow on ground this morning at 6 a.m.; rain and snow during the night yielding ·94 in. of water. Ther. 32°; bar. 29·40; wind N.E. From what I can hear it is 54 years since a similar fall occurred in these parts in May; it then fell on either the 12th or 13th.—*Robert Cross.*

SOUTHAM VILLA, CHELTENHAM.—On Tuesday, the 12th, the heat was oppressive; the maximum temperature in shade reached 79°·0, the highest May temperature I have recorded during the past 14 years, and higher than that of any day in 1879, 1882, 1883, 1890. This morning was cold, wet and miserable; the hills were covered

with snow, and the temperature at 1 p.m. was only 41°·0, rising, however, in the afternoon, to 48°·2, which is the lowest May maximum I have recorded later than the 10th.—*Richard Tyrer, B.A., F.R.Met.Soc.*

TEAN VICARAGE, STOKE-UPON-TRENT.—Bitterly cold on 16th and 17th, about 2 inches of snow on the ground on the morning of the 17th, and more fell during the day.—*G. T. Ryves, F.R.Met.Soc.*

THE HEATH HOUSE, STOKE-UPON-TRENT.—Snowed almost continuously from 3.30 a.m. till 2.30 p.m. on 16th, and again on 17th. —*J. C. Philips.*

ORLETON, TENBURY.—Even here in this warm, sheltered valley, the snow was 2 inches deep at 10 p.m. on Whit Sunday, and on the hills round 4 to 6 inches deep, and lay till 1 p.m. next day. I am afraid that the frosts and snow have injured the fruit and hops. An old woman who works for me tells me that on May 16th, 1833, there was snow 12 inches deep. She remembers it because her youngest brother was born then.—*T. H. Newport-Davis, F.R.Met.Soc.*

HAREWOOD LODGE, MELTHAM, HUDDERSFIELD.—May 13th: Shade maximum 73°·9.—15th: Severe storm of thunder and lightning at 4 o'clock in the afternoon, accompanied by a fall of large hail balls (these were hard snow, not ice) of more than half-an-inch diameter; the barograph curve for this day shews numberless small variations, with a jump of 0·06 in. at about 4 p.m.—17th: Shade maximum 45°·0; snow showers all the forenoon.—18th: Shade minimum 23°·8, grass 19°·8. This is by far the lowest temperature in May for the last 13 years, the next lowest being 27°·2 on May 2nd, 1887. Without exaggeration almost every leaf in the garden is damaged; I enclose you a sample taken from a large beech.—*Charles L. Brook, F.R.Met.Soc.*

BOOTHAM SCHOOL, YORK.—Min. in shade on 18th, 24°.—*J. E. Clark.*

YORK ROAD, DRIFFIELD.—Min. in Stevenson's screen on 18th 22°·1, and on grass 12°; terrible destruction of fruit.—*J. Lovel.*

Finally we have to consider whether this changeableness is to be pronounced unprecedented; we think not. Some of its features probably are. The temperatures at Driffield are very low, but no record for that station exists, except for two or three years. At York Mr. Clark has a minimum of 1° less than previously recorded in May in York, but the sites of the thermometers, and the thermometers themselves, have undergone many changes, and that 1° is not such a great difference after all. At Camden Square, May, 1867, was decidedly the more remarkable of the two, both the heat and the cold lasting longer, and the former being much greater.

MAXIMA, above 77°.				MINIMA, below 35°.			
1867.		1891.		1867.		1891.	
Date.	Degree.	Date.	Degree.	Date.	Degree.	Date.	Degree.
6	84·0	12	79·7	*22	34·3	17	30·7
7	83·2	13	80·2	23	31·8	19	33·4
8	82·0			24	33·1		
10	80·1			25	32·3		

* The day on which the Derby was run in a snow storm.

THE THEORY OF HALOS AND PARHELIA.

(*Continued from p.* 55.)

We have next to consider the horizontal white band passing through the Sun. This is accounted for by reflection from the vertical faces of the crystals. As there is no refraction, no colour is produced, and there is no change in the elevation of the image. The result is to produce a horizontal white band, which may be compared to the "path" of the Sun or Moon seen on the surface of rippling water, the difference being that in that case the reflecting surfaces (the faces of the wavelets) are arranged in a horizontal plane while the reflecting surfaces of the ice crystals are in a vertical plane.

The vertical white band passing through the Sun which is occasionally seen, is explained in a similar manner by reflection from the horizontal flat ends of crystals which have their axes vertical. But when this upright pillar of light is seen, it appears not unfrequently to constitute the whole of the visible phenomenon. An example of this is described and figured in *Met. Mag.*, vol. vi., p. 96. In such a case it appears probable, as conjectured by M. Bravais, that the result is produced by crystals of a peculiar shape having a flat hexagonal plate at each end. Crystals of this form are described and figured by Scoresby in his work on the Arctic Regions, and would be admirably adapted to produce this appearance by reflection from their flat extended extremities, but not so well suited to produce the other phenomena of the halo.

It may possibly be objected to the foregoing explanation that it represents the tangent circles and the white band through the Sun as horizontal, whereas, in fact, they appear to curve considerably upwards. It will not, however, be difficult to see that this curvature is an effect of the perspective or apparent figure of the sky. Horizontal lines on the sky, that is lines parallel to the horizon, are necessarily circles or parts of circles described about the zenith, and therefore the curvature increases with the elevation. A horizontal line of moderate length seen near the horizon would probably be described by many observers as straight, while one near the zenith would certainly be seen to be curved. In intermediate positions it is not unlikely that the same line might appear straight to one observer who referred it to the horizon, and curved to another who referred it to the zenith. This would account for the discrepancy in the observations of the halo of January 29th, 1890, some observers putting the mock suns, which are on the horizontal white band precisely level with the real Sun, others making the band curve upwards. (*Met. Mag.*, vol. xxv., p. 1).

We have spoken of the tangent circles as produced at the highest points of the circles round the Sun, by crystals which (in the case of the upper circle) have their axes all vertical. It is plain, however, that a set of parallel crystals having their axes inclined to the vertical at any constant angle would produce a similar tangent circle at some

other point. Such an arrangement of crystals may occasionally occur under the influence of air currents, and obliquely placed tangent arcs are sometimes, though rarely, observed.

It remains to explain the parhelia or mock suns themselves. These are frequently seen at the points where the parhelic circle crosses the halo of 22 degrees, and it was therefore a simple explanation, and one that has often been accepted, to say that the illumination at this points is doubled, the effects of reflection and refraction being combined. Unfortunately, however, there is a fatal objection to this explanation in the fact, which is well attested by observation, that the mock suns are not always at the crossing of the two circles, but are sometimes observed to be as much as three or even four degrees outside the halo. The distance from the halo varies with the height of the Sun above the horizon, being greatest when the Sun is highest, while, when the Sun is low, the parhelia are seen at the crossing of the two circles. It is clear, therefore, that some other explanation is required, and this is furnished by the theory of M. Bravais, which is, that while the halo is formed by crystals having their axes perpendicular to the plane passing through the Sun, the eye, and the crystal, as already explained, the parhelia are formed by a similar refraction through crystals having their axes vertical. When the Sun is on the horizon this distinction no longer holds good, for in that case the eye and the Sun are in the same horizontal plane, and the parhelia will be on the halo at the points where it is crossed by the parhelic circle. But when the Sun has attained any considerable elevation above the horizon, it is evident that a ray which is so refracted through a vertical crystal as to reach the eye, must pass not in a plane perpendicular to the axis, but obliquely; and if the effect of cutting a prism by a plane inclined to the axis be considered, it will be seen that a ray so passing is refracted by an angle greater than 60°, and will therefore be more refracted than one traversing a plane perpendicular to the axis, and the parhelion will therefore be farther from the Sun than the halo. It is difficult to represent this in a perspective drawing, and the mathematical calculation involves formulæ of some complexity; but it may be illustrated by a simple experiment, which any one interested in the subject can easily repeat. For this purpose we require a prism so mounted that it may be easily rotated about its axis. I have found the following a simple and efficient arrangement:—Take an ordinary glass prism, and cement one of the flat ends to a glass "slide," 3 in. × 1 in., and secure this on a brass turn-table, such as is used in making cement cells for microscopic objects. Also mount the cap taken from the eye-piece of a microscope upon any convenient stand. The object of this is to keep the eye in the same plane throughout the experiment. Place the cap at the distance of about 20½ inches from a dark screen, and exactly opposite to it fix a small white wafer on the screen. If the prism is now introduced between the eye-cap and the screen in a suitable position, which will easily be found by trial, two images

of the wafer will be seen, one uncoloured, formed by reflection from the surface of the glass, and the other coloured, produced by refraction. By rotating the prism slowly on its axis, the position of least deviation for the coloured image will be found to be about 16 inches from the wafer itself, corresponding to an angular distance of 38°. This represents the position of the mock sun and of the portion of the halo which is then coincident with it, when the Sun is on the horizon. If, now, another wafer be placed 9½ inches above the first, answering to an angular elevation of 25°, and its image looked at in the prism occupying the same position as before, the white and coloured images will still be seen in the same horizontal line with the wafer itself, but the coloured image will be about 20 inches from the wafer. This corresponds to an angular distance of about 42°, and represents the position of the parhelion when the Sun is 25° above the horizon. Next let the bed of the turn-table be tilted up until it points in the direction of the wafer representing the Sun. The axis of the prism will then again be perpendicular to the plane in which refraction takes place, and the image will return to a distance of about 17½ inches from the wafer, which, as the distance from the eye to the wafer is now 22½ inches instead of 20½ as at first, will correspond to the same angular distance of 38°, and will represent a point on the halo. Thus it will be seen that with a prism of glass instead of ice, the elevation of the Sun being 25°, the distance of the halo from the Sun will be 38°, and the distance of the parhelion 42°. The greater distances are of course accounted for by the fact that the index of refraction of glass is greater than that of ice. If we reduce the radius of the halo from 38° to 22°, and reduce the distance of the parhelion in like proportion, it will be found to be about 24°; or, in other words, when the Sun is 25° above the horizon the parhelion should be 2° outside the halo, which corresponds very nearly with the results of exact mathematical calculation.*

Some other points of interest about the solar halo may be illustrated with the same simple apparatus. For this purpose it is better to use a small flame instead of the white wafer. A candle at the distance of five or six feet, or a gas burner turned down low will answer the purpose. The eye-cap may be dispensed with. If now the coloured image be observed, and brought to the position of least deviation, it will be found that the prism may be turned a considerable distance, as much perhaps as ten degrees without producing any perceptible movement in the position of the image; but when once the image does begin to move, it moves rather rapidly as the prism is turned further. From this it appears that if in the place of one prism we had a number of small prisms, all with their axes vertical, but variously turned about their axes, a considerable

* M. Bravais gives 23° 59′ as the calculated distance of the parhelion from the Sun at an altitude of 26°.

number of them would throw the image almost, though not exactly, on the same spot, at and near the position of minimum deviation, while beyond that position only one prism would throw the image to any given point. Several facts connected with the halo and parhelia are explained by these considerations.

First, with regard to the parhelion, the bright end nearest the Sun is produced by the crystals at and near the position of least deviation throwing their images one upon another. The pale end, the tail as it may be called, is produced by crystals passing from the position of minimum to that of maximum deviation, which throw the images further apart, so that they do not fall so much one upon another, and thus give a less degree of illumination. This may be seen by rotating the prism rapidly, the colourless images produced by external and internal reflection will combine into the white band of the parhelic circle.

We may suppose the ice crystals floating in the air to be in every possible position both with regard to the inclination of the axes, and the rotation of the crystal, but the long needle-shaped crystals would have a natural tendency to assume a vertical position under the influence of gravity. Hence there would be a much larger number perpendicular to the horizontal plane then to the other inclined planes in which the refraction must take place to produce the halo. This accounts for the greater brightness of the parhelia, and also for the fact that no fringe corresponding to the tails of the parhelia is seen round the halo, its illumination being (from the comparatively small number of crystals forming it) too faint to be observed. The faint colours of the halos, as compared with the tangent arc, is explained by the overlapping of the images partially reproducing white light. In the upper tangent arc especially there will be no such overlapping, the refracting angles being all in the same position.

The Ice Crystals.

A few words may be said in conclusion about the form and distribution of the ice crystals. We have seen that the theory requires (1) Refracting angles or 60° and 90°. (2) Numerous crystals in all possible positions, so that among them a sufficient number may occur in those positions which are requisite to produce the halos; just as in a shower of rain a sufficient number of drops are found to occupy those exact situations which are necessary to produce the rainbow. (3) A preponderating number of crystals with their axes horizontal to produce the lower tangent circle, and a preponderating number with their axes vertical to produce the upper tangent, the parhelic circle, and the parhelia. It is a mistake, however, to suppose, as some have done, that in order to make Bravais' theory workable it would be necessary "to go up and arrange the prisms after our own fancy, putting all those in one region with their axes vertical, all those in another region with their axes horizontal, and all those in a

third region with their axes in every possible direction." (*Met. Mag.*, vol. vi., p. 78.) On the contrary, there is good reason to believe that the necessary conditions with respect to the refracting angles and the inclination of the axes would occur spontaneously; the separation into regions is altogether unnecessary.

First, with regard to the angles. The most common form of ice crystal is the hexagonal with flat ends, and this is also the form best suited to the theory. The angles between the flat ends and the sides are angles of 90°, and there will be twelve such angles in every crystal. The angle between two adjacent sides is 120°, but no light could be refracted through so wide an angle;* the effective angles are those between the alternate sides, which are of 60°, and of these there are six in each crystal. Then there are in all eighteen effective angles in every crystal, from which it follows that there are numerous positions in which the crystal might serve to produce some part of the halo. Next, as to the inclination of the axes. There are two distinct varieties of hexagonal crystals, namely, the acicular form, in which the axis is much longer than the breadth of the crystal, and the lamellar form in which the axis is very short, so that the crystal is a flat hexagonal plate. Under the influence of gravity the acicular crystals would naturally have a tendency to fall with their axes vertical, and the lamellar with their axes horizontal. It can hardly be doubted that there are also intermediate forms with their axes nearly equal in length to the breath of the crystal, and then, having no special tendency to fall in any particular position, would be found with their axes in all directions.

Lastly, as to the number of the crystals. The crystals themselves are very minute; a snow flake consists of many such crystals variously united, and a snow shower must contain millions of them; but we do not require such immense numbers to produce the halos. All the phenomena hitherto discussed are regarded as produced by light which, having been once refracted, comes straight to the eye without being intercepted by a second crystal. It is clear that the presence of too many crystals would interfere with this, for the rays which should have reached the eye to form the image would probably be again intercepted by other crystals. Thus no halo is produced in an ordinary snow storm. In fact, snow has been called opaque. It is opaque in the same way in which broken glass is opaque. Each separate piece is transparent; but the light which is refracted by one falls on another, and then again on a third, and so on, there being a certain loss at each refraction until the whole is dissipated. In the higher region of the atmosphere, however, where air and aqueous vapour are both of greater tenuity, the ice crystals would not be united into snow flakes, but would fall at greater intervals from each other; and even then it is probable

* The widest angle through which refraction can take place in a crystal of ice is 100°. If the angle be greater than this, the light is internally reflected from the second surface.

that only a thin veil of such frozen mist is required to produce the halo. Whether any of the phenomena of the halo are produced by light which, after being refracted by one crystal falls upon another, and is a second time refracted, is a doubtful question. Mock suns are occasionally, though rarely, seen in connection with the halo of 46°. With regard to these M. Bravais considered it uncertain whether they were caused by two successive refractions through an angle of 60°, or by one refraction through an angle of 90°, though he inclined to the former explanation. In order to determine the point, he required a fuller and more accurate series of measurements of the distances of these parhelia from the Sun at various altitudes, and this, I believe, is still a desideratum. Some other rare phenomena of the halo are probably to be explained by the occurence of other refracting angles in less usual forms of ice crystal.

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ROYAL METEOROLOGICAL SOCIETY.

The usual monthly meeting of this Society was held on Wednesday evening, May 20th, at the Institution of Civil Engineers, 25, Great George Street, Westminster; Mr. Baldwin Latham, M. Inst., C.E., F.G.S., President, in the chair.

Dr. M. G. Foster, M.A., and Mr. J. Robinson, J.P., were elected Fellows of the Society.

The following papers were read:—

1. "On the Vertical Circulation of the Atmosphere in relation to the formation of Storms;" by Mr. W. H. Dines, B.A., F.R.Met.Soc. After giving an outline of the circulation of the atmosphere, the author referred to the two theories which have been suggested to account for the formation of storms, viz.: (1) the convection theory, which is, that the central air rises in consequence of its greater relative warmth, this warmth being produced by the latent heat set free by condensation, and (2) the theory that the storms are circular eddies produced by the general motion of the atmosphere as a whole, just as small water eddies are formed in a flowing stream of water. The author is of opinion that the convection theory is the more probable of the two, but that more information about the temperature of the upper air is greatly needed.

2. "On Brocken Spectres in a London Fog;" by Mr. A. W. Clayden, M.A., F.R.Met.Soc., F.G.S. During the dense fogs in February last, the author made a number of experiments with the view of raising his own 'spectre.' This he ultimately succeeded in accomplishing by placing a steady lime-light a few feet behind his head, when his shadow was projected on the fog. He then made some careful measurements of the size and distance of the "spectre," and also succeeded in taking some photographs of the phenomenon.

3. "An Account of the 'Leste,' or Hot Wind of Madeira;" by Dr. H. Coupland Taylor, F.R.Met.Soc. The "Leste" is a very dry and parching wind, sometimes very hot, blowing over the island from E.N.E. or E.S.E., and corresponds to the Sirocco of Algeria, or the hot north winds from the deserts of the interior experienced in Southern Australia. During its prevalence a thin haze extends over the land, and gradually thickens out at sea until the horizon is completely hidden. It is most frequent during the months of July, August and September, and usually lasts for about three days.

Mr. Shelford Bidwell, M.A., F.R.S., exhibited an experiment shewing the effect of an electrical discharge upon the condensation of steam. The shadow of a small jet of steam cast upon a white wall is, under ordinary conditions, of feeble intensity and of a neutral tint. But if the steam is electrified, the density of the shadow is at once greatly increased, and it assumes a peculiar orange brown hue. The electrical discharge appears to promote coalescence of the exceedingly minute particles of water contained in the jet, thus forming drops large enough to obstruct the more refrangible rays of light. It is suggested that this experiment may help to explain the intense darkness, often tempered by a lurid copper glow, which is characteristic of thunderstorm prevalence.

THE GREAT SNOWSTORM OF MARCH, 1891.

To the Editor of the Meteorological Magazine.

SIR,—Perhaps the statement in your Magazine for April, p. 40, that you had "only three records of the density of the snow," refers only to the storm of the 9th and 10th March; but if it was intended also to cover the storm of the 7th and 8th March, you must have overlooked my remark on p. 24 in the March number that here the 14½ ins. of snow represented about 0·94 in. of water (= 15 : 1). It is true the water was not measured simultaneously with the snow; but as there was no drifting it may be taken as very close to the truth. But I can give you some other measurements of the same storm, which show how much the density depends on the time elapsed. At 0.50 p.m. on the 8th, though the snow had continued to fall with little intermission, the depth was reduced to 12½ ins., which yielded 1·07 in. water (12 : 1); and at 5.50 p.m., when it had again increased to 13·7 ins., this gave 1·29 in. water (11 : 1); I am told that it had rained a little in the meantime, though I saw only snow. This measurement was about 22 hours after the snow began to fall.

Yours truly, T. W. BACKHOUSE.

West Hendon House, Sunderland, June 6th, 1891.

[We had overlooked the remark; but when writing were thinking solely of records from southern counties, where the storm was most exceptional. For further details see ante p. 64.—ED.]

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, NOV., 1890.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	58·1	23	20·8	29	48·8	37·4	39·9	89	87·5	17·8	1·62	17	6·9
Malta	73·4	...	45·9	...	66·0	55·1	50·9	77	128·2	37·6	1·87	12	4·6
Cape of Good Hope	84·3	23	44·0	14	72·3	55·9	...	...	...	...	1·41	...	3·7
Mauritius	82·2	29	63·0	17	79·7	68·3	64·9	76	137·0	58·0	2·80	15	5·8
Calcutta	82·7	4, 9	57·4	15	80·1	62·7	63·7	78	144·0	48·3	·01	1	1·8
Bombay	89·1	1	69·0	21	85·7	73·3	68·9	71	137·0	53·9	1·25	4	2·3
Ceylon, Colombo	88·4	20	70·8	19	85·4	72·9	71·0	80	147·0	67·0	12·32	24	5·8
Melbourne	94·5	6	45·3	16	67·0	50·8	49·0	71	141·3	37·0	4·88	13	6·6
Adelaide	96·1	6	45·7	14	73·8	54·4	48·4	57	153·1	38·8	2·20	11	5·6
Wellington	74·0	26	39·0	5	64·8	48·0	46·3	70	129·0	34·0	2·86	12	3·7
Auckland	71·5	25	47·0	5	66·3	53·6	49·5	69	138·0	40·0	3·48	12	6·0
Jamaica, Kingston	91·6	20	68·8	29	88·1	71·4	69·2	74	...	...	2·73	...	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	59·0	9	15·9	28	43·7	30·4	30·7	79	...	9·0	3·59	17	7·0
New Brunswick, Fredericton	55·6	8	7·9	24	39·5	23·5	27·5	77	...	...	2·81	16	6·9
Manitoba, Winnipeg	55·9	4	— 1·1	30	39·0	18·8	23·8	79	...	...	·43	9	5·1
British Columbia, Esquimalt	55·2	21	33·0	6	50·6	40·4	44·4	95	...	...	1·74	18	6·9

NOVEMBER REMARKS.

MALTA.—Mean temp. 59°·1 ; mean hourly velocity of wind, 10·8 miles ; sea temp. fell from 70°·5 to 65°·0. TSS on 3 days ; L on 7 days. On 29th a strong after-glow, lasting till 1 hour 10 minutes after sunset ; very similar to the after-glows of 1883.
J. SCOLES.

Mauritius.—Mean temp of air, 1°·1 below ; dew point 0°·7 above, and rainfall ·82in. above, their respective averages ; mean hourly velocity of wind, 9·5 miles, or 1·4 below average ; extremes 19·8 on 9th and 0·0 on 20th ; prevailing direction, S.E. by E. ; from 16th to 23rd inclusive N. and W. winds prevailed. L on 8th and T on 28th and 29th.
C. MELDRUM, F.R.S.

Ceylon, Colombo.—TSS occurred on 17 days, and L was seen on 7 other days.
J. C. H. CLARKE, Lieut.-Col., R.E.

Melbourne.—Mean temp. of air 1°·6 below average ; temp. of dew point 0°·4; humidity 4, amount of cloud 0·7, and rainfall 2·34 in. above their respective averages. Prevailing wind S., strong on 7 days ; heavy dew on 3 days ; hail on 29th, thunder and lightning on 6th and 29th ; thunderstorm with heavy showers on 24th.
R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 2°·8 below the average of 33 years ; mean max. temp. and also mean daily range, the lowest on record for November. Rainfall 1·21in. above the average, and the greatest fall in November since observations began, 33 years ago.
C. TODD, F.R.S.

Wellington.—R below the average. Showery in the early part of the month, and fine during the latter part, excepting very heavy rain with a N.W. gale on 26th. Prevailing wind, N.W., frequently strong, especially on the 11th and 26th. On the whole tolerably fine. Lightning on 2nd. Temp. very near the average, but rainfall 1·31 in. below it.
R. B. GORE.

Auckland.—On the whole a cold, showery and squally month. R about ·50 in. in excess of the average; mean temp. slightly below the average.—T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL, MAY, 1891.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in			in.
II.	Dorking, Abinger Hall.	2·75	XI.	Builth, Llanwrtyd Wells	3·56
,,	Margate, Birchington...	3·13	,,	Rhayader, Nantgwillt..	4·14
,,	Brighton, Prestonville Rd	2·62	,,	Corwen, Rhug	3·54
,,	Hailsham	2·33	,,	Carnarvon, Cocksidia ...	1·74
,,	Ryde, Thornbrough	3·04	,,	I. of Man, Douglas	1·48
,,	Alton, Ashdell.....	2·93	XII.	Stoneykirk, Ardwell Ho.	2·26
III.	Oxford, Magdalen Col...	2·15	,,	New Galloway, Glenlee	2·71
,,	Banbury, Bloxham	...	,,	Melrose, Abbey Gate...	1·91
,,	Northampton	2·82	XIII.	N. Esk Res. [Penicuick]	...
,,	Cambridge, Fulbourne..	3·95	XIV.	Ballantrae, Glendrishaig	1·81
,,	Wisbech, Bank House..	2·77	,,	Glasgow, Queen's Park.	2·75
IV.	Southend	2·09	XV.	Islay, Gruinart School..	1·77
,,	Harlow, Sheering	2·99	XVI.	Dollar.....	2·08
,,	Rendlesham Hall	2·65	,,	Balquhidder, Stronvar..	2·65
,,	Diss	2·15	,,	Coupar Angus Station..	1·60
,,	Swaffham	3·19	,,	Dunkeld, Inver Braan..	2·41
V.	Salisbury, Alderbury...	2·94	,,	Dalnaspidal H.R.S. ...	3·81
,,	Warminster	3·16	XVII.	Keith H.R.S.	3·79
,,	Bishop's Cannings	2·73	,,	Forres H.R.S.	2·50
,,	Ashburton, Holne Vic....	4·84	XVIII.	Fearn, Lower Pitkerrie.	2·34
,,	Okehampton, Oaklands.	3·82	,,	Loch Shiel, Glenaladale	2·78
,,	Lynmouth, Glenthorne.	3·52	,,	N. Uist. Loch Maddy ...	2·19
,,	Probus, Lamellyn	2·11	,,	Invergarry	1·12
,,	Launceston, S. Petherwin	...	,,	Aviemore H.R.S.	2·90
,,	Wincanton, Stowell Rec.	2·72	,,	Loch Ness, Drumnadrochit	2·93
,,	Wells, Westbury.....	...	XIX.	Lairg H.R.S.	3·02
VI.	Bristol, Clifton	3·78	,,	Scourie	3·62
,,	Ross, the Graig	3·73	,,	Watten H.R.S.	2·19
,,	Wem, Clive Vicarage ...	3·73	XX.	Dunmanway, Coolkelure	3·88
,,	Cheadle, The Heath Ho.	2·91	,,	Fermoy, Gas Works ...	2·51
,,	Worcester, Diglis Lock	3·51	,,	Darrynane Abbey.....	3·39
,,	Coventry, Coundon	3·34	,,	Tipperary, Henry Street	3·43
VII.	Ketton Hall [Stamford]	2·88	,,	Limerick, Kilcornan ...	2·03
,,	Grantham, Stainby	3·22	,,	Ennis	2·23
,,	Horncastle, Bucknall ...	2·57	,,	Miltown Malbay.....	1·62
,,	Worksop, Hodsck Priory	3·27	XXI.	Gorey, Courtown House	3·08
VIII.	Neston, Hinderton	2·35	,,	Mullingar, Belvedere...	3·04
,,	Knutsford, Heathside...	3·16	,,	Athlone, Twyford	2·87
,,	Lancaster, Southfield...	...	,,	Longford, Currygrane...	2·71
,,	Broughton-in-Furness..	2·75	XXII.	Galway, Queen's Coll...	2·12
IX.	Ripon, Mickley	2·21	,,	Crossmolina, Enniscoe..	3·48
,,	Scarborough, West Bank	2·92	,,	Collooney, Markree Obs.	3·32
,,	East Layton [Darlington]	2·12	,,	Ballinamore, Lawderdale	2·57
,,	Middleton, Mickleton..	1·65	,,	Lough Sheelin, Arley ..	2·04
X.	Haltwhistle, Unthank..	1·31	XXIII.	Warrenpoint	1·56
,,	Bamburgh.....	1·17	,,	Seaforde	2·69
,,	Shap, Copy Hill	...	,,	Belfast, New Barnsley..	3·92
XI.	Llanfrechfa Grange	4·93	,,	Bushmills, Dundarave...	2·79
,,	Llandovery	3·42	,,	Stewartstown	3·33
,,	Castle Malgwyn	3·21	,,	Buncrana	2·65

MAY, 1891.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average. 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date	No. of Nights below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·72	+ ·82	·66	17	19	80·2	13	30·7	17	1	5
II.		Maidstone (Hunton Court)...	2·60	+ 1·22	·47	20*a*	20	...	...	...	...	...	...
,,		Strathfield Turgiss	3·18	+ 1·31	·45	17	21	80·3	13	29·2	17	2	11
III.		Hitchin	3·18	+ 1·23	·85	17	19	75·0	13	31·0	17	1	...
,,		Winslow (Addington)	3·62	+ 1·52	1·11	17	19	76·0	13	28·0	17	2	7
IV.		Bury St. Edmunds (Westley)	2·67	+ ·92	·90	17	15	72·0	12*d*	26·0	17	...	...
,,		Norwich (Cossey)	3·17	+ 1·50	·80	17	15	73·0	14	26·0	17	3	...
V.		Weymouth(LangtonHerring)	2·08	+ ·47	·49	23	17	71·0	11*d*	34·0	17	0	...
,,		Barnstaple.....	2·78	+ ·58	·41	17	14	76·0	12	31·0	19	...	...
,,		Bodmin (Fore Street)	4·44	+ 1·91	·68	7	21	...	...	...	...	...	...
VI.		Stroud (Upfield)	4·46	+ 2·42	·70	24	19	78·0	13	32·0	16*f*	2	...
,,		ChurchStretton(Woolstaston)	3·69	+ ·82	·80	21	22	74·5	12	30·0	17	3	7
,,		Tenbury (Orleton)	3·75	+ 1·20	·65	21	22	79·8	13	27·5	19	2	7
VII.		Leicester (Barkby)	2·64	+ ·67	·40	25	17	79·0	13	27·0	18	6	11
,,		Boston	1·88	+ ·16	·40	24*b*	15	85·0	13	27·0	17	3	...
,,		Hesley Hall [Tickhill].....	3·20	+ 1·16	·54	21	16	76·0	12	26·0	18	5	...
VIII.		Manchester(PlymouthGrove)	2·40	+ ·05	·33	28	20	75·0	12	30·0	17	2	3
IX.		Wetherby (Ribston Hall) ...	1·37	— ·58	·41	24	11	...	...	...	...	...	...
,,		Skipton (Arncliffe)	3·41	— ·31	·59	1	19	74·0	13	22·0	17	4	...
,,		Hull (PearsonPark)	3·31	+ 1·43	·64	24	19	...	...	...	...	..	...
X.		Newcastle (Town Moor)	1·84	+ ·09	·70	26	14	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	5·46	— 3·15	·92	28	18	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	5·18	+ 2·33	1·23	23	17	...	...	...	...	...	...
,,		Haverfordwest	4·03	+ 1·67	·64	24	20	70·0	13*e*	29·0	19	3	6
,,		Carno (Tybrith)	2·63	— ·62	·39	28	18	71·0	11	24·0	17	11	...
,,		Llandudno.....	1·98	+ ·05	·43	28	17	68·1	31	32·4	18	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	2·51	— ·01	1·09	27	13	75·6	12	26·0	18	3	...
,,		Jedburgh (Sunnyside).....	1·83	— ·07	·33	27	17	75·0	12	30·0	17	2	...
XIV.		Old Cumnock	1·97	— ·47	·35	14	18	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	1·89	— 1·46	·51	1	15	...	...	...	...	...	...
,,		Oban (Craigvarren)	1·72	...	·58	1	14	68·8	11	34·0	17	0	...
,,		Mull (Quinish).....	1·54	— 1·41	·31	1	16	...	...	...	...	...	...
XVI.		Loch Leven Sluices	1·90	— ·66	·30	1*c*	9	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	2·35	+ ·69	·75	1	9	71·3	12	31·1	17	1	...
XVII.		Braemar	2·12	— ·29	·47	1	15	68·2	12	28·0	17*f*	7	20
,,		Aberdeen (Cranford)	2·90	...	·45	18	23	70·0	12	29·0	16	2	...
XVIII		Strome Ferry.....	1·65	— 1·70	·39	14	12	...	...	...	...	...	...
,,		Inverness (Culloden)	2·06	+ ·56	·78	2	4	70·0	12	31·0	17	1	12
XIX.		Dunrobin	2·22	+ ·12	·39	17	12	70·0	12	32·0	16	1	...
,,		S. Ronaldsay (Roeberry).....	2·72	+ 1·00	·83	26	20	64·0	12	30·0	15*g*	2	...
XX.	IRELAND.	Dromore Castle	...	...	...	...	...	...	...	...	...	..	...
,,		Waterford (Brook Lodge) ...	3·79	+ 1·56	·77	7	18	71·0	12	32·0	21	1	.
,,		O'Briensbridge (Ross)	2·18	...	·41	7	21	73·0	12	33·0	21	0	...
XXI.		Carlow (Browne's Hill)	3·49	+ 1·15	1·05	7	19	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	2·79	+ ·86	·60	28	17	67·8	12	32·8	18	0	6
XXII.		Ballinasloe	2·49	— ·20	·53	28	21	68·0	12	27·0	18	8	...
,,		Clifden (Kylemore)	5·94	...	·89	22	24	..	...	...	...	...	...
XXIII		Waringstown	3·64	+ 1·20	·69	7	20	80·0	12	24·0	10	5	9
,,		Londonderry (Creggan Res.).	3·14	+ ·62	·66	7	19	...	...	...	...	...	...
,,		Omagh (Edenfel)	3·22	+ ·75	·65	7	20	70·0	12	34·0	16*h*	0	5

a And 24. *b* And 25. *c* And 2,3,30. *d* And 13. *e* And 14. *f* And 18. *g* And 16. *h* And 17, 20

+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON MAY, 1891.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—A cold ungenial month, with ground frosts up to the very last day.

HITCHIN.—Such an instance of winter and summer in one week must be without a parallel. Sunday, the 10th, snow; Wednesday, a hotter day than was ever before recorded so early in May, and snow again on the Friday, Saturday and Sunday following.

ADDINGTON.—A very unseasonable month. Rainfall only twice exceeded during 20 years—namely, in 1878, when 4·89 in. fell, and in 1886, when 4·35in. fell. A very damaging frost occurred on the 17th, doing much injury to both fruit and vegetables.

COSSEY.—Snow fell on the 17th to the depth of 6 or 7 inches.

LANGTON HERRING.—Mean temp. 2°·5 below the average of 19 years. The changes of temp. from the 13th to the 17th were sudden and great. A little snow fell on the 16th with R. Solar halos were seen on 20th and 23rd, and distant T was heard on 26th. Barometer generally low.

BODMIN.—A very cold month. Sharp frost on the 19th; sleet and hail on the 16th; T and L on the 21st; N. and N.W. winds prevailing—more like March than May.

STROUD.—Everything very backward; the tops of potatoes cut off by frost. Ash trees came into leaf on the last two days.

WOOLSTASTON.—A month of varying temperature. The first ten days were cold and chilly; but the temp. rose suddenly, and the 11th and two following days were very hot; the temp. then fell as suddenly as it had risen, and on the 15th, after very severe storms of H, snow began to fall, and fell heavily at intervals during the two following days. The remainder of the month was cold and wet; mean temp. 48°·6.

ORLETON.—A month full of changes, and with great extremes of temp. The first ten days about the average, then four very hot days, the max. on the 12th and 13th being higher than on any day in the whole of the summer of 1890. Much colder from the 14th to 16th, with heavy storms of S on the latter day, and a depth of two inches on 17th; hard frost on the 19th, doing much damage to potatoes, hops, fruit, &c.; from thence to the 27th very cold, but slightly warmer at the end of the month. T on 19th, 20th, 23rd and 27th. Mean temp. of the month 2°·5 below the average.

LEICESTER, BARKBY.—A variable month. Potatoes and other things severely cut by the frost on the 18th. T on 15th and 27th, with H on the latter day; S on 16th and 17th.

BOSTON.—A sharp frost occurred on the 17th; the min. temp. falling to 27°, the lowest recorded in May during 27 years.

HESLEY HALL.—Vegetation of all kinds very backward; frosts on the 17th and 18th doing much damage; S on 16th and 17th. T on 28th.

MANCHESTER, PLYMOUTH GROVE.—Summer-like weather on 7th, 8th, 12th, 30th and 31st. S and H showers on 16th, and 17th; T and L on 15th and 28th. Mean temp. 50°·5.

HULL, PEARSON PARK.—The weather during the month was generally cold, E. winds prevailing. Usually fine, with light clouds from the 1st to the 14th, and showery from the 15th to nearly the end of the month.

WALES.

HAVERFORDWEST.—A large number of fine, bright but cold days, with a large number of wet nights; a very hot bright period from the 13th to the 17th, followed by a sudden and abrupt fall of temp., with four or five sharp

frosts in shade. Prevailing winds N. and N.N.E. Owing to the large amount of rain, vegetation, in spite of the cold, made rapid strides. Lowest temp. on grass 25°.

SCOTLAND.

CARGEN.—A month of extremes. With four exceptions, the max. temp. of 75°·6, on the 12th, is the highest recorded in May during 31 years; and the min. temp. of 26°, on the 18th, is the lowest—a range of temperature of 49°·6 in six days. On one or two occasions the range of temp. was from 25° to 30° in 12 hours. Notwithstanding the two or three very warm days from 11th to 13th, the mean temp. of the month was 2°·7 below the average. S fell on the 16th, 17th and 20th. The H storm on the 27th was the heaviest experienced for many years, and did much damage to the fruit blossoms, &c. TSS occurred on the 5th, 15th, 23rd, 27th and 28th.

JEDBURGH.—The weather was very cold and ungenial, more so than is remembered in May by elderly people. Vegetation, though greatly retarded, was not much injured. Want of grass was much felt. S on hills on 15th; H on 16th, 17th, 19th, 20th and 23rd; T and L on 28th.

OLD CUMNOCK.—Frost on the 4th; T, H and R on the 15th. Hills covered with H on 16th, and the low ground on 17th.

OBAN.—The month was very cold and dry, with northerly and easterly winds prevailing. In the middle the cold was quite severe, with occasional frost. Vegetation of all kinds most backward.

MULL, QUINISH.—A cold, withering, parching month from first to last; all vegetation very backward.

INVERNESS, CULLODEN.—The month was very ungenial, and the pastures were exceedingly backward.

S. RONALDSAY, ROEBERRY.—Very rough and cold weather during the middle of the month; the beginning and latter part fine.

IRELAND.

WATERFORD, BROOK LODGE.—T on the 21st, 23rd and 27th, with L, and H showers. Potatoes damaged by frost on the 17th. Mean temp. 48°·9.

O'BRIENSBRIDGE, ROSS.—It was a cold and ungenial month, made more distinctly evident by the contrast of one real summer's day on 12th. There were several slight frosts, damaging fruit blossoms, early potatoes and other tender plants.

DUBLIN.—Cold for the most part, showery and unsettled, with an overwhelming prevalence of polar wind and frequent falls of H. Only from the 10th to the 13th inclusive was there anything like summer heat. Mean temp. 49°·6, or 2°·4 below the average of May for 25 years. A solar halo was seen on the 8th, and a lunar halo on 17th. High winds on 8 days; S or sleet on 16th and 17th; H on 8 days; T on 28th.

BALLINASLOE.—A cold and harsh month, with constant frost up to the 20th, and high wind from the 21st to the 31st. H on 15th and 16th.

EDENFEL.—The month commenced in fairly seasonable weather, and during the second week the thermometer marked a higher temperature for the date than has been recorded in 27 years, except in 1871 and 1881. From the 14th to the end all these conditions changed as far in the other direction, and a cold, cheerless, inclement period followed, with H, rain, S and frequent night frosts, and strong polar and easterly winds during the day.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCCVI.] JULY, 1891. [PRICE FOURPENCE, or 5s. per ann. post free.

PRODUCING RAIN ARTIFICIALLY.*

SOME of our readers may have seen that the Congress of the United States, on the motion of the Hon. C. B. Farwell, of Illinois, recently voted a sum of money for experiments, to ascertain whether heavy artillery firing will produce rain at times when otherwise it would not occur.

The Hon. member's action seems to have been promoted by the persistent efforts of Mr. E. Powers, C.E., of Delavan, Wisconsin, who has kindly sent us a copy of his work upon the subject. It is the second edition, as nearly all the first edition was destroyed in the great Chicago fire of 1870. After that disaster the author took to pushing the subject by lectures, and in 1890 he brought out the revised edition, which we have just received. It is chiefly composed of accounts of battles followed by thunderstorms and more or less heavy rain—with a few pages of theoretical matter. It contains the authors petition to Congress, asking it to order experiments to be tried, and an estimate of their probable cost.

The author does not seem to be aware that the matter has already often been discussed on this side of the Atlantic—the titles of two papers at once occur to us "Cannons and Tempests" and "Suggestions for causing rain at will," and on referring to the "Bibliography of Meteorology" we find the titles of 24 books and articles upon the subject, only two of which (and one of them his own) appear to be mentioned by the author. His book therefore must be regarded not as a monograph upon, but merely as a plea for attention to, the subject.

Our United States friends have a far better country in which to try the experiments than we have, and we are glad that they are doing it. Congress has voted £1800 for the cost of the experiments and we wish them success. We learn from *Iron* that the first experiments will be made in Western Kansas this month, under the direction of Colonel Dyrenfurth, of Washington. Balloons filled with hydrogen and oxygen gas will be sent up and exploded by a

* "War and the Weather." By Edward Powers, C.E. Revised Edition, 8vo., 1890. E. Powers, Delavan Wisconsin.

steel wire attached to the balloons and connected with an electrical apparatus on the ground. Senator Farwell favours this idea, because the concussion will be greater, and the greater the concussion, the more copious will be the fall. The balloons will also be aided in their work by the explosion of dynamite on the ground. Drought is the curse of the Western farmer. In the state of Kansas, the western part especially, the eastern part of Colorado, the South-west Territories, Texas, the two Dakotas, Nebraska, Minnesota, and, indeed, in nearly all the country west of the Mississippi River, the dry seasons are frequent and dangerous to the welfare of the crops. The removal of this great incubus of the farmer would be a decided boon.

Our friends however, must not run away with the idea that it is a new discovery, because in the very first book that we took down after reading Mr. Powers', viz., Steinmetz's *Sunshine and Showers*, 1867, we read as follows, p. 336:—

"There may be few or no localities in our agricultural districts exactly adapted to produce rain by a conflagaration of waste materials, long grass, &c.; but we see no reason why the Government might not permit the trial of artillery in various parts of the country during seasons of protracted drought—when the skies are often crowded with tantalizing clouds which will not send down their moisture. This would be a much better use of gunpowder than when blazed away on field days and in bloody battles. A hundred or two of our guns might be sent off and posted in various parts of the country, and fired after the manner of a siege, when no doubt the same result will ensue as on the occasions we have instanced,—at the same time giving 'practice' to the men in working the guns."

In conclusion we offer Mr. Powers one hint which may be useful when the experiments come off. We cannot at this moment put our hands on *Cannons and Tempests* which appeared *about* 1863, but we think that the author held that the rain did not fall precisely where the explosions occurred. We think that the cannon to control London weather were to be in the Isle of Lewis—but perhaps that was to increase the rainfall thereabouts and thereby to diminish that in London.

Since this article was written two things have happened.

A first experiment has been made by exploding a balloon—and rain fell afterwards.

A long and careful report upon the subject, by Mr. Fernow, Chief of the Division of Forestry, U.S.A., has appeared in the June number of the *American Meteorological Journal*.

THE UNITED STATES WEATHER BUREAU.

UPON the wisdom or otherwise of the Act of the United States Congress in separating the Weather Service from the Signalling branch of the War Department, by which it has hitherto been conducted, it would be presumptuous for us to offer any opinion. Meteorological offices have relations with so many of the affairs of life, that it is not remarkable that political chiefs do not know where to put them. The English one was first put jointly under the Board of Trade and Admiralty, and is now a complete anomaly—being paid for by the State, and adminstered by an Honorary Council who accept Honoraria for their services. In France the excellently managed Bureau Central is under the Minister of Instruction. In America the meteorological service has been under the War Department, henceforth it is to be under that of Agriculture. On the whole it seems to us that the influence of the original Brussels conference and of such men as Maury, FitzRoy and Buys Ballot is waning, and Marine meteorology, except by Dr. Neumayer, is being pretty much left to take care of itself—of course if our impression is wrong it can be corrected. In the United States we believe that Marine Meteorology is dealt with by the Coast Survey Department, so that, as in Germany, there are practically two Meteorological Offices in the United States.

However, our present object is personal rather than adminstrative. We have to "speed the parting, welcome the coming" chief. General Greely is one of those who needs no commendation, his name will be remembered not merely for his Arctic trials and successes, but as an able administrator, particularly careful that his subordinates should have the credit. each of what he did. In fact Greely much resembles Father Perry in his tendency to self-abnegation. All workers in Meteorology have suffered through the non-fulfillment by General Greely's office of the distinct pledge of his predecessor to print the Bibliography of Meteorology, but we are quite aware that this was not through any failure of interest, or of will, on the part of General Greely, but the result of an act of Congress passed with a good intention, but having a very bad result.

General Greely retains the supervision of the Signal Service, retains his interest in Meteorological work and (as already intimated on p. 43) the approbation of many friends on both sides of the Atlantic.

Prof. Harrington, F.L.S., F.R.Met.Soc., who has been appointed Chief of the U. S. Weather Bureau, is best known in this country through the *American Meteorological Journal*, which he started in 1884, and has edited up to the present time (latterly being joined by Mr. A. Lawrence Rotch and by Dr. Herdman). Prof. Harrington was born in Illinois in 1848, graduated at Michigan in 1868, and became Instructor in Biology in that University. From that duty he was for a time detached, in order to go as Astronomical Assistant

to Mr. Dall in his reconnaissance of Alaska in 1870. Six years later Harrington went to Leipzig for further study, but within a few months was appointed Professor of Astronomy and Mathematics at Pekin; the climate, however, did not suit him, and he was obliged to return to America. In 1879 he was made Professor of Astronomy and Director of the Observatory at Ann Arbor, Michigan, and, lastly, as above stated, he in 1884 started the *American Meteorological Journal.*

Professor Harrington has accepted a position of high honour, for it puts him side by side with Hann, Mascart, Mohn, Neumayer, Russell, Scott, Tacchini, Von Bezold, Wild, and other leaders of meteorological work, but far in front of them all as regards the funds at his disposal. With an unfettered control over 879,753 dollars or £175,950 a year, and freedom to launch out in any direction he likes, the power now placed in Prof. Harrington's hands is unique. May he justify the selection, and may the prediction of one of his colleagues be fulfilled, that "under his direction the American Weather Bureau will hold the first place among the meteorological services of the world."

ROYAL METEOROLOGICAL SOCIETY.

THE concluding meeting of this Society for the present session, was held on Wednesday evening, the 17th instant, at the Institution of Civil Engineers, 25 Great George Street, Westminster; Mr. Baldwin Latham, M.Inst.C.E., President, in the chair.

Mr. J. J. Colman, M.P., Mr. E. B. Duhoff-Gordon, B.A., Mr. G. E. Leon, Mr. F. de C. Meade, Assoc.M.Inst.C.E., and Mr. F. Russell, F.R.G.S., were elected Fellows of the Society.

Mr. A. J. Hands, F.R.Met.Soc., gave an account of a curious case of damage by lightning to a Church at Needwood, Staffordshire, on April 5th, 1891. The Church was provided with a lightning conductor, but Mr Hands thinks that when the lightning struck the the conductor, a spark passed from it to some metal which was close to, but not connected with it, and so caused slight damage to the building.

Mr. W. Ellis, F.R.A.S., read a paper "On the Mean Temperature of the Air at the Royal Observatory, Greenwich, as deduced from the photographic records for the forty years from 1849 to 1888," and also gave some account of the way in which, at different times, Greenwich mean temperatures have been found.

Mr. Ellis also read a paper "On the comparison of thermometrical observations made in a Stevenson screen, with corresponding observations made on the revolving stand at the Royal Observatory, Greenwich." From this it appears that the maximum temperature in the Stevenson screen is lower than that of the revolving stand, especially in summer, and the minimum temperature higher; whilst

the readings of the dry and wet bulb thermometers on both the screen and the stand, as taken at stated hours, agree very closely together.

Mr. W. F. Stanley, F.R.Met.Soc., exhibited and described his "Phonometer," which is really a new form of chronograph designed for the purpose of ascertaining the distance of a gun from observations of the flash and report of its discharge, by the difference of time that light and sound take in reaching the observer. The instrument can also be used for measuring the distance of lightning, by determining the time interval between the flash and the report of the thunder.

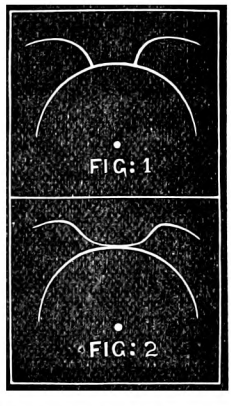
A paper was also read by Mr. A. B. MacDowall, on "Some suggestions bearing on weather prediction".

On Tuesday evening, July 7th, the Society held a dinner at the Holborn Restaurant, in commemoration of its entry into new premises at 22, Great George-street, S.W. The chair was occupied by the President, Mr. Baldwin Latham, C.E., who was supported by four Past Presidents, by three out of the four Vice-Presidents, by the three Secretaries, and by the Treasurer. After the usual loyal toasts, that of the Navy being responded to by Rear-Admiral Maclear, the toast of the evening—"Success to the Royal Meteorological Society"—was proposed by Mr. A. R. Binnie, Engineer-in-Chief to the London County Council, who pointed out the relations of meteorology to practical work, and the necessity of promptly and thoroughly discussing the data already collected. Mr. Symons (General Secretary) in replying, drew attention to the remarkable vitality of meteorologists, quoting the names of eleven of the present Fellows who had joined the Society in 1850, including Lord Ebury, Mr. Glaisher, and the Treasurer, who, though in his ninety-first year, was present to prove his argument, and to speak for himself, which he subsequently did. Mr. Symons urged that the scientific turn of mind and the regularity of life indispensable in a good observer, coupled with some little time spent in the open air, was doubtless the cause of the longevity of meteorologists, of which he gave other illustrations. Among points dwelt upon by other speakers, we may note that Dr. Barnes called attention to the general good character of English weather, although it was so frequently abused, and Dr. Theodore Williams expressed his concurrence, quoting in support thereof the physique of English men and women. The President and some other speakers referred to the comfort of the Society's new rooms, the excellence of its Library, and the satisfactory way in which its venerable Treasurer administered its finances. The last toast, "The Visitors," was proposed by Mr. H. J. Marten, C.E., and coupled with the name of Mr. F. J. Jackson, who, in responding, expressed the hope that it was the last time that he should be there as a visitor, as he should prefer to reappear as a Fellow.

THE THEORY OF HALOS AND PARHELIA.

To the Editor of the Meteorological Magazine.

SIR,—I have been much interested in the account of halos in your magazine, which is mostly very clear, but I should like the following points explained. A certain halo is spoken of as "the tangent to the inner circle," p. 54 and elsewhere; but the varying shape of this halo is not made sufficiently clear. When the sun is low the expression *tangent* appears to be quite incorrect. I have used the term *branch-halo* myself for describing this halo, as it usually starts at an angle from the ordinary halo at a little distance on each side of the vertex, as shown in fig. 1; though I do not know whether



theoretically it might be drawn as in fig. 2, in which case the term "tangent" would be correct. I think the term "arc" which is used on p. 50, also cannot fairly be applied to its usual appearance. Only some of the varying shapes af this halo are alluded to on p. 51, top paragraph. I conclude that the word "eclipsed" near the bottom of that paragraph is a misprint for "elliptic." While the exact shape is not given on p. 54, line 10, from the bottom, one might also infer that it was the arc of a circle with the zenith at the centre.

There are one or two other misprints; on p. 72, line 13 from the bottom, *or* should be *of*.

The sentence in the middle of p. 72, beginning—"This accounts" is not very clear; and as a matter of fact, I should have said the fringe to the ordinary halo is usually visible, whether it is accompanied with parhelia or not. No explanation is given why the parhelia, as well as the halo, are occasionally without tails or fringe, even when bright.

Yours truly,

T. W. BACKHOUSE.

West Hendon House, Sunderland,
24th June, 1891.

SUNSHINE RECORDERS.

To the Editor of the Meteorological Magazine.

SIR,—On p. 152 of the last vol. of the *Met. Mag.* you drew attention to a paper entitled, "A comparison between the Jordan and Campbell-Stokes Sunshine Recorders." By F. C. Bayard, L.L.M., F.R.Met. Soc. (From *Quar. Jour. Roy. Met. Soc.*) You remarked "We call attention to this paper because we believe that few persons are aware of the difference between the records of *sunshine* by the Campbell-Stokes burning instrument, and of the *sunlight* by the Jordan photographic one."

"Mr. Bayard, as the result of observations on 355 days during 1888 and 1889, found the per centage of duration to be :—

[Here followed details as to the seasons.]

	Sunshine.	Sunlight.
"Year.....	100	130

"Stronger evidence of the necessity for avoiding confusion between the two modes of observation could hardly be imagined."

The matter being one of importance, I recently caused an ordinary Jordan photographic sunshine recorder, made by Messrs. Negretti and Zambra, to be examined at Kew Observatory, and a certificate relating to it, of which the following is an exact copy minus the headlines, has just been issued by Mr. Whipple, at a charge of 10s. 6d. :—

"I hereby certify that the Jordan Sunshine Recorder, No. "208, by Negretti and Zambra, London, has been compared "with the Stokes-Campbell Recorder of this Observatory, and "found to give practically identical results."

(Signed) G. M. WHIPPLE,
Kew Observatory, June, 1891. *Superintendent.*

What are poor Observers to conclude from such contradictory asseverations ?

Yours faithfully,

JOSEPH BAXENDELL.

The Observatory, Birkdale, Southport.
22nd June, 1891.

[If the above does not justify our protest against the results from these two types of instrument being grouped together we do not know what would. It is not for us to impugn the accuracy of either Mr. Bayard or Mr. Whipple, we merely print what is certainly "Stronger evidence of the necessity for avoiding confusion between the two modes of observation than" we anticipated. ED.]

A CHANGEABLE MAY.

To the Editor of the Meteorological Magazine.

SIR,—I have just received the June number of your *Magazine*, and may inform you that here, in part of Lorraine, in the N.E. of

France, 1100 ft. above sea-level, we have had similar changes, not merely in May but also in June.

On May 13th the max was	75°·9
In the night, 17th–18th, the min. was.....	35°·1
Range	40°·8
On June 4th the max. was	78°·1
In the night, 12th–13th, the min. was	37°·8
Range	40°·3

On this night there was a white frost in some gardens.

Yours very truly,

V. RAULIN.

Montfaucon d'Argonne (Meuse), France.
June 18th.

ON CLOUD AT GREENWICH.

To the Editor of the Meteorological Magazine.

SIR,—In the valuable address on this subject, delivered by Mr. Ellis at the Royal Meteorological Society a few years ago (*Qu. Jo.*, July, 1888), he gives (p. 189) as the ascending order of the seasons in respect of cloud (70 years being considered): Autumn, spring, summer, winter. This is based, I suppose, on the fact that the least cloudy month (on a 70 years' average) is September, the next May, &c. Between those two minima, the curve rises to a low secondary maximum in July.

If we take the average of the three months of each season, we get, I find, a somewhat different order, viz.: Summer (6·48), Spring (6·57), Autumn (6·63), Winter (7·32). And examining each of the seven decades separately, summer comes out the least cloudy season in five of them, and spring in two; never autumn. The differences between these three seasons are obviously small.

While September is the least cloudy month (on an average), those 70 years show the minima to fall in various months. They fall about as often in one half of the year as in the other. Not so the maxima. The month of maximum cloud is (on a 70 years' average) January, the next December; and, taking the years separately, one finds maxima about twice as often in the earlier half of the year as in the later.

In meteorological studies, we are naturally on the outlook for some trace of sun spot influence. A curve of the annual figures for cloud does not appear to indicate such influence. I compared the distribution of cloud in the years of maximum and minimum sun spots, and may note the fact (though possibly without significance), that in all the maximum sun spot years of the series (viz., 1829, '37, '48, '60, '70, and '83,) the absolute minima of cloud were in the earlier half of the year, (viz., three times in May, and one each in March, April, and June). In the minimum sun spot years, the cloud

minima occurred three times in one half and three times in the other.

As regards the cloud maximum this falls in four of the sun spot maximum years in the second half, and in two in the first. In the sun spot minimum years, it falls four times in the first half, once in the second, and in one year the lowest value appears in two months, one in each half of the year.

Mr. Ellis has chiefly considered months; we may here briefly look at *seasons*, a little further.

While summer, according to our way of reckoning, is the least cloudy season, not only are there some years in which it has been *less* cloudy than any autumn month, but there are some years in which it has been *more* cloudy. The range is greater: in autumn from 5·2 to 7·4, in summer from 4·6 to 8·2.

It occurred to consider the question as to sequence in weather of seasons. Is there any tendency for a season with cloud above or below the average, to be followed by a season of like character? The figures seem to favour this idea in the case of seasons with excess of cloud. That is, in all four sequences of seasons, there were more cases of a season with more than the average cloud being followed by a season with also more than the average of cloud, than by a season with deficiency of cloud. The tendency (if one may infer its existence), seems most pronounced in spring and summer. Of 33 years in which spring had an excess of cloud, 25 showed the summer to have also an excess, and only 8 a deficiency.

The corresponding figures for summer and autumn were 23 and 15; for autumn and winter 19 and 11, for winter and spring 18 and 14 (not far from equality).

On the other hand, there have been (in each of the four seasonal sequences) about as many cases of a season with deficiency of cloud being followed by one with excess as by one with deficiency, except in the case of winter and spring. While 8 winters with deficiency of cloud were followed by springs with excess, 17 were followed by springs with deficiency.

Perhaps we may at least say, on the strength of these figures, that a cloudy spring tends to be followed by a cloudy summer, and a winter with little cloud by a spring with little cloud. It would be interesting to know how far this corresponds with the experience of your readers.

In a paper to the British Association at Aberdeen in 1885 (*Report* p. 913) Mr. Fox finds (1) a very cold spring tends to be followed by a cold and wet summer; a very cold summer tends to be followed by a cold autumn; (3) very warm summers are prone to be succeeded by warm autumns.

The first two seem to agree with what we should expect from the phenomena of cloud as above represented.—Yours faithfully,

A. B. M.

DRY YEARS AND CROYDON SPRINGS.

The following little table, for which we are indebted to Mr. Baldwin Latham, C.E., President R.Met.Soc., affords a striking illustration of the effect of dry years upon the yield of the Croydon springs. The measurements have been made under identical conditions in each of the last ten years, and always on the same date.

Yield of Croydon Springs on June 10th of each year.

1882.....	978·7	cube feet	per minute.
1883.....	1120·8	,,	,,
1884.....	849·2	,,	,,
1885.. ...	688·1	,,	,,
1886.....	933·7	,,	,,
1887.....	867·2	,,	,,
1888.....	796·2	,,	,,
1889.....	1039·2	,,	,,
1890.....	896·6	,,	,,
1891.....	597·4	,,	,,

REVIEW.

The Meteorological Results of the "Challenger" Expedition in relation to Physical Geography. By A. BUCHAN, M.A., LL.D., Secretary, Scot. Met. Soc. (Excerpt Proc. Roy. Geog. Soc., March, 1891.) 8vo, 22 pages, 6 plates.

As the officials of the "Challenger" office, and of the Royal Society of Edinburgh, and the publishers of the "Encyclopædia Britannica," alike ignore the existence of the *Meteorological Magazine*, we editorially have not had the pleasure of following Dr. Buchan's work for some years past. The above little pamphlet having arrived, we are, as ever, ready to give it a hearty welcome.

In the opening paragraph Dr. Buchan recounts the circumstances attending and following the preparation (more than twenty years since) of his first paper on the mean atmospheric pressure upon the globe. There is no doubt that, by that one paper he did more towards promoting accurate knowledge of the elevation of various parts of the earth's surface than any traveller (unless, indeed, it be Humboldt), has ever done, and he is perfectly justified in reminding his hearers of the fact, but he puts it far too mildly. "A more exact method" is an expression doubly erroneous: (1) "exact" cannot be qualified; if a thing is exact, it is exact, and nothing can make it "*more* exact"; (2) "more exact" implies that the previous process was not exact and the lines which follow those words show how bad the old method was. Dr. Buchan should have said, "an approximately correct method was substituted for the previous very unsatisfactory one."

It is impossible for us to follow the whole paper, which, as its title implies, is chiefly a summary of the volume published in the "Challenger" series, but we can pick out a few facts,—*e.g.*:

"Observations on the temperature of the surface were made every two hours of the day as part of the scientific work of the expedition. From 1512 observations made in the North Atlantic, the mean latitude being 30° and longitude

42°, it is conclusively shown that the daily change of the temperature of the surface of this ocean is only 0°·8. Similarly in the South Atlantic, lat. 33° and long. 20° W., it was 0°·8; in the North Pacific, lat. 37° and long. 170° W., it was 1°·0; and in the South Pacific, lat. 36° and long. 87° W., it was 0°·9. In the equatorial portions of the Atlantic and Pacific the daily variation was 0°·7; and in the higher latitudes of the Southern Ocean it was only 0°·2. Hence, in the great oceans away from land, and between lat. 40° N. and 40° S., the surface temperature nowhere shows a daily variation exceeding a degree Fahrenheit. Near the equator the daily range falls to three-fourths of a degree, and still further to one-fifth of a degree in high latitudes."

"Over the open sea the humidity curve closely follows that of the temperature, being at the minimum at four in the morning, and at the maximum at two in the afternoon. But near land very different conditions prevail; here a second minimum takes place from about 10 a.m. to 2 p.m.—a feature altogether absent over the open sea."

"Over the open sea the diurnal oscillations of the barometer are shown in their simplest and exactest [*sic*] form, the disturbing influence of land being wholly wanting. The remarkable result is this, though the atmosphere there overlying the ocean, and, therefore, resting on a floor whose diurnal variation of temperature does not exceed a degree Fahrenheit, yet the diurnal oscillations of the barometer are as marked, and as decided as they are over the land where the diurnal variation of temperature is great. In accounting, therefore, for these oscillations, it is virtually unnecessary to take the temperature of the surface into consideration. What is insisted on here is that while the temperature of the surface leaves its impress on the diurnal barometric curve by important modifications thereby produced, yet the barometric oscillations themselves are independent of the temperature of the earth's surface. Hence the cause must be sought in the daily changes which take place in the temperature and humidity of the air through all its height, due to solar and terrestrial radiation."

We do not remember having seen the fact stated elsewhere that at sea the velocity of the wind has no diurnal curve. On land, as we have often mentioned, the greatest velocity occurs usually shortly after noon; but it will be remembered that we gave a diagram showing, on the authority of M. Angot, that at the top of the Eiffel Tower, this law did not hold good, and now Dr. Buchan says that at sea there is no regular curve.

Dr. Buchan devotes a page to the consideration of the hour of greatest frequency of TS and of L over land and over sea, but he makes no reference to the difficulty of seeing faint lightning during daylight, and it seems to us that this serious disturbing cause diminishes the value of the conclusions arrived at.

As regards the isobars, the author points out the causes which, in his opinion, render observations from stations in narrow valleys useless, and he gives instances which support his view.

Referring to the isothermal map for January, Dr. Buchan points out the extreme cold of Werkojansk, in N.E. Siberia (67° 34′ N. and 133° 51′ E.), where the January average is —61°·2, *i.e.*, 93°·2 below freezing, and where in January, 1886, the absolutely lowest air temperature ever known occurred, viz., —88°·8, or —120°·8 below the freezing point of water, and nearly 50° below the freezing point of mercury. In fact, with an average of —61°·2, there is nothing but the cost, to prevent quicksilver being generally used there both for bullets and for small shot.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, DEC., 1890.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	43·7	4	14·9	22	34·0	25·5	26·8	86	49·3	5·5	·68	9	8·1
Malta	67·2	1	45·8	15	61·2	50·5	46·8	77	116·9	39·0	4·11	19	5·7
Cape of Good Hope	97·2	3	53·5	31	80·0	59·7	...	...	...	...	·64	...	4·8
Mauritius	83·9	29	66·3	12	81·5	71·3	67·5	76	137·0	58·7	2·18	12	6·5
Calcutta	83·5	10	47·5	29	77·4	56·8	57·6	74	143·4	37·9	·03	1	0·9
Bombay	86·4	28	65·2	14	83·6	70·5	66·0	69	133·0	49·1	·13	1	2·7
Ceylon, Colombo	89·2	29	68·3	29	86·7	73·1	68·5	73	150·0	62·5	8·47	17	5·3
Melbourne	88·9	5	42·7	17	70·8	52·3	50·0	66	142·3	34·0	1·40	10	6·2
Adelaide	95·6	5	48·5	8	80·6	58·3	49·2	49	160·5	39·2	·20	4	4·1
Wellington	73·3	18	44·0	3	68·0	55·1	51·7	72	137·0	35·0	5·07	12	3·8
Auckland	78·5	14	50·0	3	72·3	57·5	54·5	70	142·0	41·0	1·98	10	5·0
Jamaica, Kingston	88·9	12	63·3	2	86·6	68·5	66·3	71	...	...	·31	...	...
Trinidad	89·0	a12	65·0	*Var*	85·9	68·1	69·7	80	152·5	58·0	5·28	18	...
Toronto	41·1	23	— 1·2	28	30·2	14·9	19·4	81	...	—6·0	1·94	23	7·3
New Brunswick, Fredericton	46·4	4	—16·8	9	18·8	—2·5	5·0	74	...	...	4·25	13	4·6
Manitoba, Winnipeg	44·8	17	—24·6	1	24·1	1·9	15·5	94	...	...	·46	10	4·8
British Columbia, Esquimalt	55·1	18	32·0	5	47·6	39·4	42·6	95	...	...	8·28	23	8·6

a. And 24th.

DECEMBER REMARKS.

MALTA.—Mean temp. 54°·9; mean hourly velocity of wind, 10·7 miles; sea temp. fell from 65°·0 to 60°·5. TSS on 5 days; L on 3 days; H on 29th. J. SCOLES.

Cape of Good Hope.—The 2nd, 3rd and 4th very hot; max. temp. 91°·2, 97°·2 and 91°·7 respectively. D. MAY.

Mauritius.—Mean temp. of air, 1°·0 below, dew point 0°·4 below, and R 3·13 in. below, their respective averages; mean hourly velocity of wind, 9·4 miles, or 1·8 below average; extremes 21·3 on 26th, 1·2 on 2nd; prevailing direction, S.E. by E.; L on 7th and T and L on 29th. C. MELDRUM, F.R.S.

Ceylon, Colombo.—TSS occurred on 7 days; L only, was seen on 3 days. J. C. H. CLARKE, Lieut.-Col., R.E.

Melbourne.—Mean temp. of air 1°·7, of dew point 0°·7, and R 1·07 in. below, humidity 2, and amount of cloud 0·6 above, their respective averages. Prevailing winds S. and S.W., strong on 8 days; heavy dews on 12 days; TS and heavy R on 28th, L on 6th, 7th, and 29th, lunar halo on 20th. R. L. J. ELLERY, F.R.S.

Adelaide.—Temp. 1°·8, and R ·62 in., below the average of 33 years. The summer so far has been unusually cold, with only a few warm days and no continuous heat. C. TODD, F.R.S.

Wellington.—Heavy R in the early part of the month, and strong N.W. wind; on the 1st, in two hours, 2 in. of R fell, and the fall in 24 hours was 2·40 in., causing floods. Fine from 6th to 17th, when heavy showers fell, and also on 18th; strong N.W. winds on 13th and 14th, though fine; very strong N.W. wind from 23rd to 27th, and showery during the latter part of the month. Slight H on 2nd. Prevailing wind, N.W. Mean temp. 0°·7 above the average. R. B. GORE.

Auckland.—A mild, warm month, with small R and light variable wind. T. F. CHEESEMAN.

ESQUIMALT.—On 31st, roses, violets, and many other flowers were in bloom in the open air. C. CARPMAEL.

SUPPLEMENTARY TABLE OF RAINFALL, JUNE, 1891.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in			in.
II.	Dorking, Abinger Hall.	1·49	XI.	Builth, Llanwrtyd Wells	3·48
,,	Margate, Birchington...	1.66	,,	Rhayader, Nantgwillt..	3·63
,,	Brighton, PrestonvilleRd	1·96	,,	Corwen, Rhug	4·21
,,	Hailsham	1·46	,,	Carnarvon, Cocksidia ...	2·92
,,	Ryde, Thornbrough	1·91	,,	I. of Man, Douglas	3·00
,,	Alton, Ashdell.....	1·22	XII.	Stoneykirk, Ardwell Ho.	·79
III.	Oxford, Magdalen Col...	1·27	,,	New Galloway, Glenlee	1·34
,,	Banbury, Bloxham	1·34	,,	Melrose, Abbey Gate...	·90
,,	Northampton	1·66	XIII.	N. Esk Res. [Penicuick]	...
,,	Cambridge, Fulbourne..	2·52	XIV.	Ballantrae, Glendrishaig	1·26
,,	Wisbech, Bank House..	1·42	,,	Glasgow, Queen's Park.	·92
IV.	Southend	1·48	XV.	Islay, Gruinart School..	1·86
,,	Harlow, Sheering	·48	XVI.	Dollar.....	·61
,,	Rendlesham Hall	·67	,,	Balquhidder, Stronvar..	2·58
,,	Diss	·96	,,	Coupar Angus Station..	·64
,,	Swaffham	·71	,,	Dunkeld, Inver Braan..	·67
V.	Salisbury, Alderbury...	1·39	,,	Dalnaspidal H.R.S. ...	1·74
,,	Warminster	1·83	XVII.	Keith H.R.S.	·81
,,	Bishop's Cannings	1·22	,,	Forres H.R.S.	·43
,,	Ashburton, Holne Vic....	4·33	XVIII.	Fearn, Lower Pitkerrie.	1·12
,,	Okehampton, Oaklands.	2·27	,,	Loch Shiel, Glenaladale	...
,,	Lynmouth, Glenthorne.	2·43	,,	N. Uist. Loch Maddy ...	2·97
,,	Probus, Lamellyn	2·51	,,	Invergarry	1·34
,,	Launceston, S. Petherwin	...	,,	Aviemore H.R.S.	·47
,,	Wincanton, Stowell Rec.	1·36	,,	Loch Ness, Drumnadrochit	1·25
,,	Wells, Westbury.....	...	XIX.	Lairg H.R.S.	1·81
VI.	Bristol, Clifton	2·32	,,	Scourie	...
,,	Ross, the Graig	...	,,	Watten H.R.S.	1·39
,,	Wem, Clive Vicarage ...	2·67	XX.	Dunmanway, Coolkelure	4·64
,,	Cheadle, The Heath Ho.	3·63	,,	Fermoy, Gas Works ...	3·52
,,	Worcester, Diglis Lock	2·56	,,	Darrynane Abbey.....	3·89
,,	Coventry, Coundon	2·50	,,	Tipperary, Henry Street	2·71
VII.	Ketton Hall [Stamford]	2·10	,,	Limerick, Kilcornan ...	2·80
,,	Grantham, Stainby	2·95	,,	Ennis	2·58
,,	Horncastle, Bucknall ...	2·73	,,	Miltown Malbay.....	3·09
,,	Worksop, Hodsck Priory	3·20	XXI.	Gorey, Courtown House	2·88
VIII.	Neston, Hinderton	4·53	,,	Mullingar, Belvedere...	2·20
,,	Knutsford, Heathside...	2·24	,,	Athlone, Twyford	2·41
,,	Lancaster, Southfield...	...	,,	Longford, Currygrane...	2·10
,,	Broughton-in-Furness..	1·99	XXII.	Galway, Queen's Coll...	2·13
IX.	Ripon, Mickley	1·03	,,	Crossmolina, Enniscoe..	2·76
,,	Scarborough, West Bank	·40	,,	Collooney, Markree Obs.	2·21
,,	East Layton [Darlington]	1·42	,,	Ballinamore, Lawderdale	2·44
,,	Middleton, Mickleton..	1·22	,,	Lough Sheelin, Arley ..	2·50
X.	Haltwhistle, Unthank..	·76	XXIII.	Warrenpoint	1·84
,,	Bamburgh.....	·66	,,	Seaforde	3·41
,,	Shap, Copy Hill	...	,,	Belfast, New Barnsley..	2·50
XI.	Llanfrechfa Grange	2·54	,,	Bushmills, Dundarave...	·83
,,	Llandovery	2·66	,,	Stewartstown	3·75
,,	Castle Malgwyn	2·86	,,	Buncrana	2·37

JUNE, 1891.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average. 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max Deg.	Max Date	Min. Deg.	Min. Date	No. of Nights below 32°: In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	·86	— 1·15	·32	22	10	79·0	22	44·9	10	0	0
II.		Maidstone (Hunton Court)...	1·73	+ ·11	·66	22	11	...	...	...	...	...	...
,,		Strathfield Turgiss	1·12	— ·68	·41	22	14	81·4	19	37·0	12	0	2
III.		Hitchin	1·73	— ·13	·55	4	11	78·0	26	40·0	8*e*	0	...
,,		Winslow (Addington)	1·09	— ·77	·29	4	11	77·0	17	39·0	12	0	0
IV.		Bury St. Edmunds (Westley)	·80	— ·99	·38	4	5	...	...	...	...	...	...
,,		Norwich (Cossey)	·87	— ·68	·50	4	8	75·0	26*a*	...	...	...	...
V.		Weymouth(LangtonHerring)	2·24	+ ·01	·76	3	11	76·0	20	45·0	8*f*	0	...
,,		Barnstaple	1·42	— ·74	·36	25	11	80·0	21	41·0	12	0	...
,,		Bodmin (Fore Street)	2·96	+ ·21	·56	3	18	...	...	...	...	...	...
VI.		Stroud (Upfield)	1·82	— ·57	·72	24	12	80·0	19	39·0	23	0	...
,,		ChurchStretton(Woolstaston)	3·14	+ ·59	·59	4	14	76·0	21	39·0	7	0	0
,,		Tenbury (Orleton)	2·48	— ·13	·64	4	11	78·3	19	37·0	12	0	0
VII.		Leicester (Barkby)	3·36	+ 1·01	1·29	4	13	83·0	13	36·0	12	0	0
,,		Boston	1·81	— ·08	·70	4	10	81·0	19	40·0	13	0	...
,,		Hesley Hall [Tickhill].....	2·64	+ ·72	1·50	4	13	77·0	24	37·0	10	0	...
VIII.		Manchester(PlymouthGrove)	3·29	+ ·64	1·15	2	11	81·0	24	40·0	10	0	0
IX.		Wetherby (Ribston Hall) ...	·93	— ·96	·41	2	4	...	...	...	...	...	...
,,		Skipton (Arncliffe)	2·18	— 1·18	·54	29	11	81·0	20	37·0	9	0	...
,,		Hull (PearsonPark)	1·10	— ·65	·37	4	8	...	...	..	...	..	...
X.		Newcastle (Town Moor)	·54	— 1·10	·25	15	9	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	3·08	— 3·50	·87	27	13	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	2·08	— ·35	·95	24	13	...	...	...	...	...	...
,,		Haverfordwest	2·05	— ·51	·64	27	13	80·0	23	40·7	11	0	...
,,		Carno (Tybrith)	3·07	+ ·33	1·07	4	13	72·0	19	32·0	10*g*	2	...
,,		Llandudno.....	3·34	+ 1·57	·91	24	12	72·6	20	42·0	7	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	1·24	— ·71	·38	25	7	81·2	20	35·0	11	0	...
,,		Jedburgh (Sunnyside).....	·90	— ·84	·38	26	6	75·0	19*b*	40·0	10	0	...
XIV.		Old Cumnock	·87	— ·99	·20	14	11	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	2·00	— 1·10	·58	29	12	...	...	36·0	7	0	...
,,		Oban (Craigvarren)	1·98	...	·35	30	11	80·9	25	41·0	8	0	0
,,		Mull (Quinish).....	2·02	— 1·27	·51	26	11	...	...	...	...	...	...
XVI.		Loch Leven Sluices	·90	— ·85	·50	27	4	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	·75	— ·75	·50	15	6	76·1	23	37·6	11	0	...
XVII.		Braemar	·87	— 1·12	·31	30	8	75·4	20	30·4	11	2	6
,,		Aberdeen (Cranford)	·35	...	·07	28	7	74·0	26	41·0	21	0	...
XVIII		Strome Ferry.....	2·24	— ·82	·50	18	11	...	..	...	...	...	...
,,		Inverness (Culloden)	·25	— ·71	·16	27	3	77·0	26	37·0	9*g*	0	5
XIX.		Dunrobin	1·68	— ·34	·63	27	6	67·0	26	39·0	9	0	...
,,		S. Ronaldsay (Roeberry).....	1·74	— ·02	·74	26	9	70·0	25	42·0	6*f*	0	...
XX.	IRELAND.	Dromore Castle	2·53	— ·63	1·02	1	11	90·0	22	48·0	9*h*	0	...
,,		Waterford (Brook Lodge) ...	2·40	+ ·33	·63	3	11	75·5	20	39·0	10	0	..
,,		O'Briensbridge (Ross)	1·20	...	·21	30	14	80·0	19*c*	44·0	1	0	...
XXI.		Carlow (Browne's Hill)	2·59	+ ·75	·72	2	13	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	2·75	+ 1·09	·60	24	14	73·8	23	43·9	10	0	0
XXII.		Ballinasloe	2·34	+ ·04	·61	30	17	72·0	20	40·0	12	0	...
,,		Clifden (Kylemore)	4·27	...	1·70	29	10	..	...	...	...	...	...
XXIII		Waringstown	2·68	+ ·61	1·28	25	14	84·0	19	37·0	11	0	0
,,		Londonderry (Creggan Res.).	1·79	— ·63	·56	25	13	...	...	...	...	..	..
,,		Omagh (Edenfel)	1·82	— ·65	·52	25	13	78·0	20*d*	41·0	5*f*	0	0

a And 29. *b* And 20. *c* And 20, 21, 22, 23. *d* And 21, 22, 23. *e* And 12. *f* And 10. *g* And 11. *h* And 19

+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON JUNE, 1891.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—On the whole a genial and seasonable month, but from the long continued cold and subsequent dry weather, crops are backward and hay will be scarce. L on the 1st and T on the 3rd.

ADDINGTON.—A very moderate quantity of R fell in this district. On the afternoon of the 24th a heavy TS raged to the S., eleven sheep and lambs being killed under one tree in the adjourning parish of Claydon. The nights of the 10th, 11th and 12th were cold, the min. on grass falling to 36° 35° and 34°. T on the 1st, 3rd, 4th, 15th, 24th and 25th.

BURY ST. EDMUNDS, WESTLEY.—Remarkable for its small R, but vegetation stood the drought well. A want of water may be soon expected in West Suffolk; the ponds are nearly dry, and the deep chalk wells are much lower than usual at this time of year. T on 2nd and 23rd.

LANGTON HERRING.—On the whole it was a very fine month; from the 7th to the 21st inclusive only ·01 in. of R fell. Mean temp. at 9 a.m. 60°·5, or 0°·2 above the average of 19 years. Fog on 15th and 29th; T on 25th.

BODMIN.—A very warm and genial month; very hot in the sun from the 14th to the 26th.

STROUD.—Very heavy TS to the N.W. over Gloucester on the 15th, but not severe here; TSS also on the 24th.

ORLETON.—A fine, favourable month for agriculture, with many warm days; the mean temp. being exactly the average of 30 years. All the R fell in the first and last weeks; none falling from 6th to 22nd inclusive. T on 6 days; L on the 4th, 24th and 25th.

LEICESTER, BARKBY.—Considerable R in the first and last weeks only. Wind frequently strong and cool, from N.E. T on 6 days.

MANCHESTER, PLYMOUTH GROVE.—Fine summer-like weather from 8th to 13th, also from 19th to 23rd; mean temp. 59°·1. Severe TS on 24th; TSS also on 2nd and 25th.

WALES.

HAVERFORDWEST.—Certainly one of the finest Junes during the last ten years. The nights were cold during the first 10 days, after which the day temp. rose suddenly and a period of great heat set in; storms threatened, but none occurred in this immediate neighbourhood. In the North East of the county severe TSS occurred, with loss of life amongst horses and cattle. From the 24th to the end a considerable amount of R fell. Prevailing winds N. and E.

SCOTLAND.

CARGEN.—The first 18 days were very cold for June, the mean temp. being only 54°·6; this was succeeded by a period of unusually warm weather, which lasted for 8 days, from 19th to 26th inclusive; the mean max. temp. being 78°·3. No R fell for 23 days, from 2nd to 24th inclusive. T was heard on the 2nd, 4th and 26th.

JEDBURGH.—The month was remarkable for the prevalence of N. and N.E. winds, with a considerable amount of sunshine. About the middle there was a good fall of R, which had a most invigorating effect on vegetation. Cereal and root crops look well. Hay will be a poor crop.

OBAN, CRAIGVARREN.—Dry and warm, with strong E. winds at the commencement. Pastures much burnt up in many parts.

MULL, QUINISH.—A very hot dry month; much needed R fell at the close. T and L on 26th.

INVERNESS, CULLODEN.—The R during the month was much under the average and pasture land, and crops generally, were suffering at the close. T on 16th, 27th, 28th and 30th ; much L on 28th.

S. RONALDSAY, ROEBERRY.—The first half of the month was very dry and cold ; winds S.E. to N.E. The latter part was warmer, with a good deal of fog, and towards the end R.

IRELAND.

WATERFORD, BROOK LODGE.—Mean temp. 57°·8. T on 1st and 15th. T and L on 24th. Sea Fogs on 5th, 16th and 17th.

O'BRIENSBRIDGE, ROSS.— R moderate, and below the average of 10 years. Warm and brilliant weather to the 24th, from thence lower temp. and moderate showers. Occasional T and L.

DUBLIN.—A generally favourable month of high mean temp. and pressure, showing a marked preponderance of N.E. and E. winds. The mean temp. was 58°·6 or 1·3 above the average of 25 years. High winds on 7 days, attaining the force of a gale on but one occasion, the 30th. Temp. reached or exceeded 70° in the screen on 6 days. T was heard on the 15th and 24th and H fell on the 15th. A heavy T shower occurred at 5.15 p.m. on the 24th followed by a severe TS half-an-hour later.

EDENFEL.—The weather of the first fortnight, although for the most part fine and dry, hardly helped the then backward vegetation, but from the begining of the third week a gentle R was followed by a whole week of ideal summer, hot days and warm nights with copious dews ; this again was followed in the last week by further sufficient rain, so that the 1st July saw covered with luxuriant promise, a country that on the 1st of June had given rise to the greatest fears for the coming harvest.

ERRATA IN METEOROLOGICAL MAGAZINE, 1890.

REGULAR TABLE.

Ely	Aug.....	should be	3·78 in.
,, ...	Sept. ...	,,	1·15 ,,

SUPPLEMENTARY TABLE.

Banbury, Bloxham	Dec.....	should be	·69 in.
Fulbourne Asylum	Oct.....	,,	2·18 ,,
,, ,, ...	Nov. ...	,,	2·10 ,,
Southend	Sept. ...	,,	1·08 ,,
Lancaster, Southfield ...	Jan.....	,,	6·86 ,,
Wakefield Prison	Mar. ...	,,	1·55 ,,
,, ,, ...	June ...	,,	2·71 ,,
,, ,, ...	July.....	,,	1·93 ,,
Dollar	Nov. ...	,,	7·60 ,,
Forres...	Sept. ...	,,	2·46 ,,
Fearn, Lower Pitkerrie	Mar. ...	,,	2·51 ,,
Galway, Queen's College	,, ...	,,	2·94 ,,
,, ,, ...	May ...	,,	2·31 ,,
,, ,, ...	Sept. ...	,,	2·73 ,,

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCCVII.] AUGUST, 1891. [PRICE FOURPENCE, or 5s. per ann. post free.

INDIAN MONSOON FORECASTS.

WEATHER forecasting in its simplest form is probably contemporaneous with civilization, and long before Meteorology became a science, sailors, shepherds and others dependent on favourable weather had acquired considerable precisionin judging the character of coming weather several hours in advance. The Meteorological Services of most nations were in a great measure founded with a similar object, more especially with regard to warning the seafaring portion of the community of the approach of dangerous storms. More recently several have arranged for the issue of forecasts for agricultural purposes, and probably the United States Service, under its new head, will greatly extend its work in this direction.

These forecasts are, we believe, rarely, if ever, issued for periods more than 30 hours in advance, and, as a rule, attempts to foretell the general character of seasons are looked upon with suspicion, although the literature of the subject, including that of cycles in the seasons, which is practically the same, is probably more voluminous than that of any branch of Meteorology except the tables of "millions of useless observations," which issue from some of the National Services of the old world.

The Indian Meteorological Office has for the past eight years issued forecasts of the probable character of the monsoon rains, the failure of which has in the past been the cause of the well-known famines which decimate the population of vast districts.

These forecasts are based upon the quantity of snowfall on the Afghan mountains and the Himalayas, and on the general character of the meteorological conditions in India during the preceding seasons, and as this year appears likely to afford an exceptional, and possibly lamentable, opportunity of judging of their value, we think it of sufficient interest to reprint the Forecast from the Official Memorandum, dated June 4th, 1891.*

* Memorandum on the snowfall in the mountain districts bordering Northern India, and the abnormal features of the weather in India during the past five months, with a forecast of the probable character of the South-West Monsoon Rains of 1891.

"*Probable character of the approaching South-West Monsoon.*—The combination of conditions which have obtained in India with remarkable persistency from the beginning of January to the present time, are the results of prolonged—probably the heaviest and most prolonged and extensive—winter snowfall in the Western and Central Himalayan area and Afghan mountains that has occurred during the past 25 years at least. The snowfall commenced in November, and has continued more or less steadily from that date until nearly the end of May. It was almost certainly as excessive in the Himalayas of the North-West Provinces as in those of the Punjab and Kashmir, and also, relatively to the normal, even more excessive in the Afghan mountain districts; hence, perhaps, also in Central Asia. In several respects the meteorological conditions strongly resemble those of the pre-monsoon of 1885, and in others those of the pre-monsoon of 1868. They resemble to a less extent those of the pre-monsoon periods of 1877 and 1878. The only favourable feature of the snowfall is that it does not appear to have been very excessive in May, although probably above the normal.

The conditions are such as are almost invariably accompanied by a considerable delay in the progress of the monsoon current up the Bombay coast, and into the interior of the North Deccan and Central India. They are also frequently accompanied by a weak Bombay current, and occasionally by the early withdrawal of that current from Upper India in the beginning of September.

The low pressure area in Assam and Burma will tend to draw the Bay of Bengal current more to the eastward than usual. The relatively high pressure conditions in Upper India, as well as the low pressure conditions in Bengal and Burma, will tend to deflect the Bombay current in the same direction, and cause it to sweep more directly across the peninsula than usual. The Bombay current will probably supplement the action of the Bay current to some extent in the North-West Provinces, Chutia, Nagpur, and perhaps South Behar. Hence the conditions are such that the Bombay current will very probably be largely diverted from North-Western India, and that Rajputana, Guzerat, and the adjacent districts to the north and east will have dry north-westerly winds to an unusual extent during the monsoon.

The chief meteorological factors of the season are so strongly marked that the minor features will probably have less influence than usual.

So far as can be judged, the trough of low pressure will occupy its normal position from Orissa through the eastern districts of the Central Provinces. Its probable position in North-Western India is very doubtful, but will probably be more easterly than usual.

There has been for some time a small area of deficient pressure in the North-West Provinces, extending from Allahabad to Lucknow. It is difficult to judge how far it will influence the distribution of the rains in the present year in Upper India, but it is an unfavourable feature so far as the East Punjab is concerned.

The following is a statement of the chief inferences respecting the probable character of the monsoon rains of the present year, drawn from the known antecedent conditions :—

1. Snowfall conditions on the Western Himalayas and Afghan mountains (and probably over a large portion of Central Asia) and the pressure conditions in India are very unfavourable to the establishment of a strong and early monsoon on the Bombay coast. It is very probable that the monsoon will not be established in full strength on the Bombay coast before the third or fourth week in June, and it is probable that it will be below its average strength, and may be withdrawn from Upper India earlier than usual in September.
2. The snowfall conditions in the Eastern Himalayas, and the pressure conditions in North-Eastern India and Burma, are favourable to the advance of a moderately strong or strong monsoon in the Bay of Bengal earlier than usual, and to its establishment in Burma and Bengal before or about its normal period.
3. Pressure and other conditions are very favourable in Burma and North-Eastern India (Bengal and Assam), and it is probable that these provinces will obtain normal or abundant rain (more or less in excess of the normal).
4. Conditions are slightly less favourable in Behar and the eastern districts of the North-West Provinces, but it is probable they will obtain about their normal rainfall. The local depression in the North-West Provinces may, if it intensifies, (which, however, does not appear, so far as can be judged from the other conditions, to be probable,) determine heavy local rain to the central and eastern districts of the North-West Provinces.
5. Pressure and other conditions are very unfavourable for Rajputana, and also to a somewhat less extent in Guzerat, the southern districts of the Punjab, and the western districts of the North-West Provinces. It is probable the rainfall will be more or less deficient over the whole of that area, and possible that the deficiency may be large and serious. If the Bombay current be strong (in consequence of at present unknown conditions in the Arabian Sea area), these provinces may receive moderate rain throughout the monsoon. In the East Punjab rainfall will probably be normal or slightly deficient, but may be unfavourably distributed in time, commencing late and terminating early.
6. Conditions are partly favourable and partly unfavourable in North Bombay and Berar, and the amount of the rainfall in these areas will depend chiefly on the strength of the Bombay current as determined by conditions in the Arabian Sea. The rainfall is on the whole more likely to be slightly deficient than to be up to its normal amount.

7. Taking into consideration the probable position of the trough of low pressure and the other known conditions, the rainfall in the Central Provinces will probably be fairly normal in character, any tendency to excess being most probable in the eastern districts.
8. In Southern India the pressure conditions are favourable for heavy rain on the Malabar coast. There may probably be some slight delay in the establishment of the monsoon on that coast, but the Malabar district and Southern India generally are likely to receive favourable rain during the monsoon.

It should be noted, as was the case last year, that one of the important factors, namely, the pressure conditions in the Arabian Sea, is again of unusual importance, and hence that the inferences stated above, more especially so far as they relate to North-Western India, are uncertain to that extent, and that this element of doubt should be carefully kept in view in judging the probabilities.

It will thus be seen that the conditions are most unfavourable for Rajputana and the districts adjacent to it, including Guzerat, South Punjab, the western districts of the North-West Provinces and some portions of Central India. The chances that the rains in that area will be more or less deficient are at least 5 to 1, and the chances that they will be largely deficient, at least 2 to 1."

THE WINTER TEMPERATURE IN ENGLAND AND SCOTLAND.

To the Editor of the Meteorological Magazine.

SIR,—The mildness of December and January in Scotland last winter, compared with England, was very notable, but it appears to have been not an uncommon feature in bygone times. In reading Dr. Anderson's Report of Aberdeenshire, which was published in the end of last century, there are examples of severe weather in England, and the contrary in the northern kingdom. It is not an uncommon remark that when snow is one foot deep at Aberdeen, it is nearly 2 feet at Newcastle-upon-Tyne. Again, in the year 1762, when the Thames at London was frozen over for many weeks, the weather was so mild in Aberdeenshire as scarcely to interrupt the ordinary operations of agriculture, and ploughs could have been at work every day. Other examples might be named, and as showing what occurs in northern latitudes, the ice-bound vessels were released in Davis Straits at Christmas, 1835, is a memorable incident.

Yours truly,

D. ROBIE.

Bedford, July 31st, 1891.

THE THEORY OF HALOS AND PARHELIA.

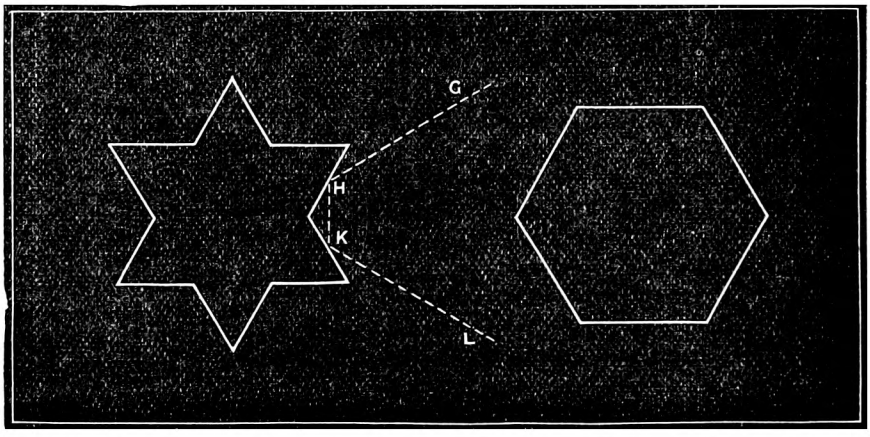
To the Editor of the Meteorological Magazine.

SIR,—Mr. T. W. Backhouse, in his letter of June 24th, suggests that the halo which I have spoken of as a tangent or tangent arc to the inner circle, should rather be called a branch halo. The form of this portion of the halo is very variable, and it is only at a certain altitude of the sun, about 12°, that it takes the form of an arc touching the circumsolar circle, and therefore I quite agree that the name branch halo would be in itself equally or more appropriate than the one I have adopted; but as I found the name tangent arc or contact arc adopted in all, or nearly all, the descriptions of the halo which I have seen, I did not feel justified in changing a name which appeared to be established. The fullest description of this part of the halo, which I have seen in any English work is contained in Loomis' Meteorology. Professor Loomis continues to use the name contact arcs while pointing out their variable forms. When the sun is near the horizon (he says), we sometimes see two branches of light like horns, rising from that part of the halo of 22° which is directly over the sun. As the sun rises higher, these two horns diverge from each other, and when it has an altitude of 12°, they approach in form to an arc of a circle, convex towards the sun. When the sun reaches an altitude of 30°, these arcs become concave towards the sun; they bend downwards and envelope the halo. At an elevation of 25°, a contact arc is sometimes seen at the point of the halo directly beneath the sun. At first it appears as an arc of a circle convex towards the sun. As the sun rises, its curvature diminishes, and at 32° it becomes concave towards the sun. At 45° the curvature of the two arcs is nearly the same, and they form together an elliptical figure surrounding the halo of 22°.

With regard to the tails of the parhelia and the fringe of the halo, my supposition is that we have short ice crystals floating in the air in all positions, and long crystals with their axes vertical. Hence there would be more crystals with their axes vertical than with their axes inclined at any given angle to the horizon, and therefore the parhelia, due to these vertical crystals, would be brighter than any given point of the halo. The tails of the parhelia are formed by the vertical crystals not in the position to produce minimum deviation. Now suppose we had a series of crystals, a, b, c,—l, m, n,—x, y, z, with their axes parallel, a in the position of minimum deviation, b rotated 1′ from this position, c 2′, d 3′, and so on up to z in the position of maximum deviation. Then the crystals a, b, c at the beginning of the series would throw their images very near together, l, m, n in the middle of the series further apart, and x, y, z at the end further apart still. Hence the further we recede from the position of minimum deviation, the fainter the illumination becomes. This explains the diminishing brightness of the tail of the parhelion. The same explanation applies to the fringe of the halo; but inasmuch as the halo, to begin with, is not so bright as the parhelion,

it follows that the fringe of the halo, at any given distance from it, will not be so bright as the tail of the parhelion at the same distance. Hence the fringe does not extend so far as the tails, and sometimes the fringe may be too faint to be seen at all, or only for a very short distance, while the tails still remain visible.

Mr. Backhouse further remarks that "no explanation is given why the parhelia, as well as the halo, are occasionally without tails or fringe, even when bright." I have not met with any explanation of this, but I would venture, with some hesitation, to suggest one. May not the cause be the prevalence at the time of some other form of ice crystal in place of the more common hexagonal figure? One of the forms known to occur is the six-pointed star, formed by the crossing of two equilateral triangles. If a crystal having this form in section be compared with one of the ordinary hexagonal shape and of equal size, it will be seen (1) that the surface available for the entrance of rays passing with minimum deviation is somewhat greater in the pointed



than in the hexagonal form, so that the halo and parhelia would be brighter, and (2) that when turned away from the position of minimum deviation, many rays would be intercepted by the projecting points in the star-like form, either externally or internally, and thus the tails and fringe would be relatively fainter, and might either disappear altogether or be very much abbreviated.

It is to be noticed that paranthelia, or parhelia, at a distance of 120° from the sun, have been explained by two reflexions, internal or external,* from crystals of this pointed form, and hence if the above explanation is correct, we should expect that paranthelia would be seen when the ordinary parhelia are without tails. G H K L represents the course of a ray forming a paranthelion by external reflexion. This theoretical connexion between the absence of tails and the occurrence of paranthelia will afford a means of testing the theory by observation.—Yours truly,

ALFRED K. CHERRILL, M.A.

123, *Adelaide Road, N. W.*

* See Heath's Geometrical Optics and Loomis' Treatise on Meteorology.

REVIEWS.

Annales de l'Observatoire Impérial de Rio de Janeiro, publiées par L. CRULS, Directeur. Tome IV., Part ii. H. Lombaerts et Cie., Rio de Janeiro, 1889. 4to, xii.—406 pages.

THIS handsome volume contains the observations at Rio *in extenso* for the three years 1883-85. It tells us nothing as to the instruments or their position, but that may have been given in an earlier volume. A work of this kind necessarily consists chiefly of tables, but a few pages of remarks would greatly increase its utility. For instance, almost the first entry we noticed was the rainfall of 223·01 mm. on one day, April 26th, 1883; surely a rain of 8·78 inches in one day must be exceptional even in Rio, so we turned to the summary for the month, but the only remark is as follows: "26th, Storm in the morning, squall from S.W. and heavy rain during the day." In 1884 the greatest daily fall was 5·02 inches on December 7th, and in 1885, 2·51 in. on December 30th; so evidently the 8·78 in. was far beyond the usual maximum.

We may give a few further figures:—

	1883.	1884.	1885.
Total Rain on roof	49·48 in.	46·76 in.	30·69 in.
,, ,, on ground.....	55·41 ,,	50·20*,,	33·89 ,,
Evaporation in sun	57·46 ,,	57·61 ,,	66·53 ,,
,, in shade	31·96 ,,	33·48 ,,	43·41 ,,
Max. temp. in shade	99·5 deg.	99·0 deg.	99·1 deg.
Min. ,, ,, ...	55·2 ,,	58·1 ,,	58·5 ,,
Mean ,, ,, ...	73·2 ,,	72·7 ,,	74·1 ,,

As considerable interest is taken in Dr. Cruls' forthcoming "Climatology," it is important to know whether his assistants and printers are accurate. The errata which are given in the introduction are few; but, without making anything like a search, we have noticed that on p. 133, July. the max. temp. should be 26°·3 not 65°·3; on p. 260, two entries of 14°·5 are in wrong type, they should have been marked as minima; and on p. 270 we have the wrong casting already mentioned.

We do not see the utility of printing vapour tensions to hundredths of a millimetre, *i.e.*, 0·0004 inch or $\frac{1}{2500}$th of a inch, but as we find that in Prof. Hazen's tables he does not stop even at hundredths of a millimetre but gives thousandths, Dr. Cruls can easily refer us to Prof. Hazen to answer our objection. We wish that he would, and tell us of what practical utility 0·00004 inch of vapour tension is; and whether two wet bulb thermometers could indicate the difference between say 42·720 mm. and 42·721 mm.; we have an impression that it would be a difference of somewhere about a thousandth of a Fahrenheit degree, but suppose it were ten times that, does anybody believe in a wet bulb thermometer reading correctly to one hundredth of a degree?

* Wrongly added in the volume as 1075·20 mm. should be 1275·20 mm. which gives 50·20 in.

Die Blitzgefahr. No. 2. Einfluss der Gas-und Wasserleitungen auf die Blitzgefahr. Herausgegeben im Auftrage des Elektrotechnischen Vereins von F. NEESEN. 8vo, 43 pages. Berlin: J. Springer. 1891.

THIS is a list (with a few explanatory woodcuts) of 128 accidents by lightning, grouped and discussed, in order to ascertain whether it is, or is not, wise to form an electric connection between the gas and water pipes leading into churches, houses and buildings, and the lightning conductors thereon. The result is to confirm the recommendation in the Report of the Lightning Rod Conference that such connection should be made. The pamphlet is a very interesting one, and should be read by all concerned with the efficiency of Lightning Conductors.

Annual Report of the Board of Regents of the Smithsonian Institution, showing the operations, &c., to July, 1888. xxxiii.—839 pages. Government Printing Office, Washington, 1890.

ONE of the best volumes in this important series. We may call especial attention to the papers on "Astronomical Progress in 1887 and 1888" (92 pages), by Mr. Winlock, and on "Recent Progress in Dynamic Meteorology" (70 pages), by Prof. Cleveland Abbe, a paper which it is impossible to epitomize, but which all advanced meteorological students ought to read and study.

SUNSHINE AND SUNLIGHT.

To the Editor of the Meteorological Magazine.

SIR,—I have noticed Mr. Baxendell's letter in the July number of the *Meteorological Magazine*, in which he expresses some surprise at a certificate of verification of one of Jordan's photographic sunshine recorders given by the Kew Observatory, and if I may be allowed, I should like to trouble you with a few words thereon.

It is, I believe, a well known fact that the burning rays registered by the Campbell-Stokes recorder, and the actinic rays registered by the photographic recorder are not the same thing, and it is also a well-known fact in photography, that the ferro-prussiate paper can be washed nearly, if not quite, white by a sufficiently long immersion in water. This latter fact will explain the difference between my figures given in the Quarterly Journal., Vol. xvi., p. 22, and Mr. Whipple's certificate given to Mr. Baxendell, for I have not the slightest doubt that the photographic papers were washed before tabulation, which would give a practical agreement with the burning recorder cards, whereas my readings as given in my paper are the readings before the papers were washed. It comes to this, that on a whole year, practically 30% of the photographic record is washed away. I may remark that the Meteorological Office have also been investigating the properties of the two recorders, and I have been informed, though I have not seen the figures, that their results and my own are practically identical.

There are also other minor disturbing causes, viz., with respect to the burning recorder ; p is rain, dew, or frost on the on the sphere the burning rays will not penetrate it, and with respect to the photographic recorder, if the rain drifts at all, it goes in at the holes, and running down inside the drum, spoils the paper, so that no trace is obtained.

I quite agree with your editorial note that the values given by the two recorders should be kept distinct, and more especially is this the case when I find that if the papers are washed in a weak solution of sulphuric acid, more of the traces are preserved than if they are washed in plain water. Is there no chemist amongst the Fellows of the Royal Meteorological Society who would devote his leisure to improving the ferro-prussiate paper?—Yours faithfully,

FRANCIS CAMPBELL BAYARD.

Wallington, 29th July, 1891.

ANOTHER CORPORATION OBSERVATORY.

BRIGHTON was, we believe, the first town to establish a second order station—others have followed—we do not remember all, but Middlesborough, Southport, Eastbourne, Croydon, Nottingham, Macclesfield, Bolton, Rochdale, Sheffield, Harrogate, and Hull, occur to us as having taken steps in this direction—though in some cases the help of the Corporation has been limited to granting the use of a portion of a public park or garden. In other cases, the Corporations have found the site, purchased the instruments, and appointed a paid curator.

The town or city of which Dr. Tatham was Medical Officer of Health, would not be allowed to do things by halves, and with such a city as Manchester at his back, it goes without saying that things have been done as they should be. For that reason, and as suggestions for other places to follow, we devote a few lines to reporting what has been done at Manchester.

Site.—This is the most important feature, and Dr. Tatham has shown his usual sound sense in selecting, not an airy suburb, but a large yard in the heart of the city, one in fact surrounded by the very air which the teeming population have to breathe. We do not know its area, but it is large enough to ensure that no object subtends at the orifice of the rain gauge a greater angle than 20°.

Instruments.—These include standard barometer ; dry and wet bulb and max. and min. thermometers in Stevenson stand ; grass min. thermometer ; earth thermometers at 1 ft. and 4 ft. ; rain gauge ; recording aneroid and thermograph.

Publication.—It is of very little use making observations unless by publication they are made generally accessible. This is efficiently done in the city of Manchester *Weekly Health Return*, which is in all respects but one, perfect—and that is a word we rarely use.—The publication is admirable, worthy of the city with its 500,000 inhabitants, and one which can stand comparison with the *Weekly*

Return of the Registrar General without any hesitation. We said that there was one respect in which the Manchester *Weekly Health Return* failed to reach perfection; it is not a meteorological one but one closely connected therewith: there is not a word respecting the supply of water, either as to its quality or quantity.

THE THUNDERSTORMS OF AUGUST 3RD, AND 4TH, 1891.

To the Editor of the Meteorological Magazine.

SIR,—On Monday, August 3rd, 1891, a severe storm passed over Sevenoaks. For fully half-an-hour before it came, thunder had been heard in the west, and the clouds had been very dark in the same direction. At 4.30 p.m. large drops of rain fell, and this was followed in a few minutes by a most tremendous fall of hail, which lasted about 20 minutes, and left the ground quite white. The hail fell almost straight down, but came rather from the W.S.W. The hailstones were large, and some measured fully half-an-inch across; one weighed over $\frac{1}{4}$ oz. 20 minutes after it fell. They made large holes in the leaves of many plants (tomatoes, marrows, dahlias, &c.) Boys were able to make snowballs of the hail. Steady rain followed this until the second and less severe hailstorm came, about 6.30 o'clock. This lasted only a few minutes. The lightning was most severe about 4.45 p.m., when it struck a building about a quarter of a mile distant, doing, however, only slight damage. The barometer stood steady at 29°·65 in., corrected for sea level. There was little or no wind all the time. The damage done to the vegetation was considerable, and the roads were torn up by the rush of water down the hills. The total of rain and hail that fell measured ·71 of an inch. It is reported that no storm occurred at Ightham, 5 miles to the E.N.E., or at Maidstone 15 miles, but at Shipborne, 5 miles E.S.E, the storm was severe. Temperature fell to 43° afterwards.

Yours faithfully, W. W. WAGSTAFFE.

Purleigh, Sevenoaks, August 5th, 1891.

To the Editor of the Meteorological Magazine.

SIR,—We had one of the sharpest storms of the series at Tenterden on the 4th at 11.45 a.m.; ·20 in. of R fell in 10 minutes; ·08 in. in three minutes. T continued in E. after the sun began to shine again, and it was only a short storm. A tree was struck at Rolvenden and nine sheep killed (3 miles W. of us), and another in a park $1\frac{1}{2}$ miles E. and nine lambs killed there.

Another tree was struck about half a mile N.E. from the town, the bark cut out in a strip from top to bottom of the tree, two to four inches wide. A similar strip eight feet up and another on the *branch* of an adjoining tree, but not down the *trunk*, almost as if the lightning went across to the other tree where the main damage was done.

Yours truly,

J. ELLIS MACE.

Dover, August 8th, 1891.

SOMETHING LIKE A SHOWER.

To the Editor of the Times.

SIR,—The importance with regard to house drainage and to sewerage of knowing the extreme rate at which rain falls is such that I am surprised that those interested in architecture and engineering so rarely try to ascertain it.

During a thunderstorm in 1878, I recorded here by far the highest intensity of rainfall observed in this country. You allowed me then to give the full details in *The Times*; perhaps, as we have just had a similar (but shorter) torrential fall, you will allow me to do the same now.

Rain had been falling at intervals during the afternoon, about a quarter of an inch falling in ordinary showers. At 5.58 p.m., I saw that it was becoming exceptional and began reading the storm rain-gauge each half-minute, with the following results :—

July 29, 1891.	Fall in the subsequent Half minute.	Minute.
5.58 p.m.	·02 in.	·04 in.
5.58.30	·02 in.	—
5.59...	·01 in.	·03 in.
5.59.30.	·02 in.	—
6.0	·02 in.	·07 in.
6.0.30.	·05 in.	—
6.1	·04 in.	·07 in.
6.1.30	·03 in.	—
6.2	·02 in.	·04 in.
6.2.30	·02 in.	—
6.3.	·02 in.	·04 in.
6.3.30	·02 in.	—
6.4	·02 in.	·02 in.
6.4.30	·00 in.	—

From the above it will be seen that although in the even minutes the greatest fall was 0·07 in., yet from 6.0.30 to 6.1.30 the fall was 0·09 in., practically a tenth of an inch a minute, and at the rate for half-a-minute of six inches an hour.

It will probably render the volume of water precipitated better understood, if, instead of leaving it in the usual rainfall expressions of depth, I convert it into feet, gallons, and pounds.

Take an ordinary London house roof, say 20 ft. by 30 ft., the area would be 600 square feet—a tenth of an inch of rain over it would be five cubic feet, or 30 gallons, or 300 lb. weight—this on the roof of one ordinary house in one minute; and with a slate roof it runs off almost as quickly as it falls.

Take an acre of slated roofs, the fall of 0·09 in. gave 327 cubic feet, or 2,036 gallons, or rather over nine tons weight of water per acre in a single minute.—Your obedient servant,

G. J. SYMONS, F.R.S.

62, *Camden-square, N. W., July* 29.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JAN., 1891.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	53·0	31	16·9	11	39·4	28·9	31·4	88	78·2	12·5	1·80	14	6·6
Malta	63·0	8	37·8	20	56·5	46·0	41·8	78	116·5	32·5	4·52	17	6·0
Cape of Good Hope	96·1	25	55·8	5	79·8	61·2	...	...	...	...	·21	5	...
Mauritius	85·2	31	65·2	4	82·6	72·0	68·5	77	140·3	57·5	4·13	18	6·4
Calcutta	81·6	19	50·7	5	77·1	54·5	55·7	73	134·6	41·7	·00	0	4·4
Bombay	90·0	31	61·5	25	83·4	67·5	62·5	65	136·0	47·1	·00	0	0·2
Ceylon, Colombo	90·6	27	67·8	1	87·8	71·5	67·0	70	144·0	62·5	1·45	4	3·0
Melbourne	103·0	4	46·3	3	76·4	54·2	51·9	64	158·8	34·0	1·21	7	5·2
Adelaide	102·0	25	50·5	22	81·7	58·5	49·8	48	158·1	39·6	·54	4	2·7
Tasmania, Hobart	87·2	8	44·2	14	70·3	50·7	52·0	73	144·0	38·0	3·53	16	6·8
Wellington	72·0	1	44·0	13	67·4	53·6	54·4	82	139·0	35·0	1·77	16	3·9
Auckland	79·0	23	50·0	17	73·5	58·1	54·4	67	142·0	40·0	2·16	11	5·7
Jamaica, Kingston	90·4	7	61·5	27	86·6	66·5	65·7	72	...	...	·41	...	...
Trinidad	87·0	*Var*	62·0	10	85·4	67·4	67·6	75	152·0	59·0	3·17	16	...
Toronto	41·9	2	— 2·0	16	30·1	16·6	22·2	85	...	—8·2	3·13	20	7·4
New Brunswick, Fredericton	48·8	12	—15·8	17	26·5	5·8	14·5	79	...	...	6·88	19	6·0
Manitoba, Winnipeg	33·5	20	—30·2	15	16·0	—1·9	...	98	...	...	·78	15	7·5
British Columbia, Esquimalt	54·4	18	30·5	9,10 &12	45·9	38·2	41·1	95	...	...	5·22	20	8·2

JANUARY, 1891, REMARKS.

MALTA.—Mean temp. 50°·3; mean hourly velocity of wind, 13·1 miles; sea temp. fell from 60°·5 to 56°·0. TS on 11th; L on 13th and 15th; H on 8 days. The coldest month known for more than 10 years. Temp. fell below 40°·0 in screen on 6 days, and remained below 47°·0 in the house for 4 days after the 16th. J. SCOLES.

Mauritius.—Mean temp. of air, 1°·6 below, mean dew point 1°·2 below, and R 2·70 in. below, their respective averages; mean hourly velocity of wind, 11·0 miles, or 0·2 miles below average; extremes 31·5 on 27th, and 0·0 on 6th; prevailing direction, S.E. by E. to E. T and L on 2nd, 12th, 14th, and 27th; T on 15th and 22nd. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—TSS occurred on the 20th and 21st; L alone was seen on the 19th and 22nd. J. C. H. CLARKE, Lieut.-Col., R.E.

Melbourne.—Mean temp. of air 1°·6, of dew point 1°·1, humidity 1, and R ·65 in. below their respective averages; cloud same as the average. Prevailing direction of wind S., strong on 8th and 12th from N., on 13th, 18th and 27th from S.W. and S. Hot wind on 4th and 18th; heavy dews on 6 days; L on 3 days. R. L. J. ELLERY, F.R.S.

Adelaide.—Temp. 4°·6 below the average of 34 years; only once has the mean temp. been lower in January, viz., in 1868. R ·30 in. below the average. The summer has been a remarkably cool one. C. TODD, F.R.S.

Tasmania, Hobart.—Mean temp. 2°·3 below the average of 7 years, due to the low minimum temperature. J. SHORTT, CAPT. R.N.

Wellington.—On the whole a showery month, especially towards the end, when heavy R fell on 25th and 26th (1·30 in. and 1·25 in.) Prevailing wind N.W., frequently strong. T on 3rd. Mean temp. 2°·1 below the average. R 1·26 in. above average. R. B. GORE.

Auckland.—An average month, with no unusual disturbances. Mean temp. 2° below the average of 24 years. R slightly less. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL, JULY, 1891.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in			in.
II.	Dorking, Abinger Hall.	2·96	XI.	Builth, Llanwrtyd Wells	3·23
,,	Margate, Birchington...	4·38	,,	Rhayader, Nantgwillt..	4·21
,,	Brighton, Prestonville Rd	2·54	,,	Corwen, Rhug	2·47
,,	Hailsham	2·92	,,	Carnarvon, Cocksidia ...	2·45
,,	Ryde, Thornbrough	2·09	,,	I. of Man, Douglas	1·31
,,	Alton, Ashdell.....	2·77	XII.	Stoneykirk, Ardwell Ho.	·52
III.	Oxford, Magdalen Col...	2·14	,,	New Galloway, Glenlee	1·22
,,	Banbury, Bloxham	1·91	,,	Melrose, Abbey Gate ...	3·28
,,	Northampton	2·17	XIII.	N. Esk Res. [Penicuick]	...
,,	Cambridge, Fulbourne..	4·29	XIV.	Ballantrae, Glendrishaig	1·53
,,	Wisbech, Bank House..	3·25	,,	Glasgow, Queen's Park.	1·35
IV.	Southend	2·37	XV.	Islay, Gruinart School..	2·34
,,	Harlow, Sheering	3·33	XVI.	Dollar.....	2·72
,.	Rendlesham Hall	3·81	,,	Balquhidder, Stronvar..	2·86
,,	Diss	3·62	,,	Coupar Angus Station..	4·03
,,	Swaffham	4·13	,,	Dunkeld, Inver Braan..	3·08
V.	Salisbury, Alderbury...	2·56	,,	Dalnaspidal H.R.S. ...	4·19
,,	Warminster	...	XVII.	Keith H.R.S.	7·07
,,	Bishop's Cannings	2·45	,,	Forres H.R.S.	5·84
,,	Ashburton, Holne Vic....	4·25	XVIII.	Fearn, Lower Pitkerrie.	...
,,	Okehampton, Oaklands.	3·03	,,	Loch Shiel, Glenaladale	5·39
,,	Lynmouth, Glenthorne.	3·05	,,	N. Uist. Loch Maddy ...	...
,,	Probus, Lamellyn	2·06	,,	Invergarry	3·56
,,	Launceston, S. Petherwin	...	,,	Aviemore H.R.S.	3·72
,,	Wincanton, Stowell Rec.	3·36	,,	Loch Ness, Drumnadrochit	5·44
,,	Wells, Westbury.....	...	XIX.	Lairg H.R.S.	4·57
VI.	Bristol, Clifton	3·19	,,	Scourie	4·68
,,	Ross, the Graig	1·70	,,	Watten H.R.S.	3·34
,,	Wem, Clive Vicarage ...	2·29	XX.	Dunmanway, Coolkelure	2·13
,,	Cheadle, The Heath Ho.	2·99	,,	Fermoy, Gas Works ...	2·53
,,	Worcester, Diglis Lock	2·30	,,	Darrynane Abbey.....	2·81
,,	Coventry, Coundon	3·06	,,	Tipperary, Henry Street	2·10
VII.	Ketton Hall [Stamford]	2·60	,,	Limerick, Kilcornan ...	1·70
,,	Grantham, Stainby	2·75	,,	Ennis	·77
,,	Horncastle, Bucknall ...	2·33	,,	Miltown Malbay.....	1·19
,,	Worksop, Hodsck Priory	2·42	XXI.	Gorey, Courtown House	1·87
VIII.	Neston, Hinderton	2·72	,,	Mullingar, Belvedere ...	1·02
,,	Knutsford, Heathside...	2·32	,,	Athlone, Twyford	1·38
,,	Lancaster, Southfield...	...	,,	Longford, Currygrane...	1·96
,,	Broughton-in-Furness..	3·42	XXII.	Galway, Queen's Coll...	·87
IX.	Ripon, Mickley	3·33	,,	Crossmolina, Enniscoe..	2·33
,,	Scarborough, West Bank	3·70	,,	Collooney, Markree Obs.	2·47
,,	East Layton [Darlington]	3·94	,,	Ballinamore, Lawderdale	1·42
,,	Middleton, Mickleton..	3·70	,,	Lough Sheelin, Arley ..	2·12
X.	Haltwhistle, Unthank..	4·02	XXIII.	Warrenpoint	1·89
,,	Bamburgh	1·66	,,	Seaforde	2·30
,,	Shap, Copy Hill	...	,,	Belfast, New Barnsley..	2·40
XI.	Llanfrechfa Grange	2·48	,,	Bushmills, Dundarave...	3·58
,,	Llandovery	4·44	,,	Stewartstown	1·92
,,	Castle Malgwyn	2·96	,,	Buncrana	3·57

JULY, 1891.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date	No. of Nights below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	3·82	+ 1·14	·76	8	17	84·3	17	44·6	28	0	0
II.		Maidstone (Hunton Court)...	3·16	+ ·98	·84	27	16	...	...	...	...	...	...
,,		Strathfield Turgiss	2·60	+ ·21	·73	27	18	80·5	17	40·5	28	0	0
III.		Hitchin	2·52	— ·20	·39	29	21	82·0	17	44·0	28	0	0
,,		Winslow (Addington)	2·13	— 1·16	·42	6	20	81·0	17	42·0	28*f*	0	0
IV.		Bury St. Edmunds (Westley)	3·50	+ ·93	·70	7	18	...	...	...	...	...	...
,,		Norwich (Cossey).....	4·13	...	·81	29	17	...	...	...	...	...	..
V.		Weymouth(LangtonHerring)	1·79	+ ·36	·62	26	13	72·0	13*a*	48·0	4	0	0
,,		Barnstaple.....	3·00	— ·47	·95	20	12	76·5	17	46·0	22	0	...
,,		Bodmin (Fore Street)	2·66	— 1·95	·38	4	17	...	...	...	...	...	...
VI.		Stroud (Upfield)	3·32	— ·25	·78	1	18	80·0	17	50·0	23*g*	0	0
,,		ChurchStretton(Woolstaston)	2·57	— ·40	·36	29	17	73·0	16	45·0	28	0	0
,,		Tenbury (Orleton)	1·73	— 1·13	·28	3	17	77·6	16	40·0	28	0	0
VII.		Leicester (Barkby)	2·24	— ·75	·43	1	18	84·0	17	41·0	3, 27	0	0
,,		Boston	2·69	— ·10	·55	29	13	85·0	17	43·0	29	0	0
,,		Hesley Hall [Tickhill].....	2·01	— ·66	·92	30	14	79·0	17	43·0	5	0	0
VIII.		Manchester(PlymouthGrove)	2·53	— 1·26	·34	1	18	80·0	17	47·0	1, 4	0	0
IX.		Wetherby (Ribston Hall) ...	4·53	+ 1·35	·96	2	13	...	...	...	...	...	..
,,		Skipton (Arncliffe)	5·91	+ ·27	1·48	7	16	75·0	19	44·0	27	0	...
,,		Hull (PearsonPark)	2·87	+ ·28	1·35	30	16	...	...	..	...	..	...
X.		Newcastle (Town Moor)	4·75	+ 1·23	·87	22	16	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	5·82	— 5·17	1·21	6	19	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	2·41	— 1·65	·44	2	17	...	...	...	...	...	...
,,		Haverfordwest	2·33	— 1·88	·50	2	18	75·2	16	42·7	12	0	0
,,		Carno (Tybrith)	2·58	— 1·50	·45	1	15	68·0	17	36·0	27	0	...
,,		Llandudno.....	1·80	— 1·20	·36	28	13	72·7	17	49·6	2	0	0
XII.	SCOTLAND.	Cargen [Dumfries]	1·68	— 2·25	·62	6	14	74·8	14	45·0	31	0	0
,,		Jedburgh (Sunnyside).....	3·74	+ ·30	·81	22	19	72·0	17	47·0	4*h*	0	...
XIV.		Old Cumnock	1·03	— 2·49	·20	2	15	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	1·57	— 2·73	·35	2	19	...	...	44·0	6, 8*i*	0	...
,,		Oban (Craigvarren)	2·70	...	·57	2	22	73·0	14	47·1	9	0	...
,,		Mull (Quinish).....	2·36	— 1·69	·49	6	19	...	...	...	...	...	...
XVI.		Loch Leven Sluices	2·10	— 1·52	·50	16	11	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	3·45	— ·01	1·25	22	13	80·9	13	44·1	7	0	0
XVII.		Braemar	2·93	— ·28	·54	3	21	70·0	10*b*	43·8	28	0	0
,,		Aberdeen (Cranford)	2·96	...	·89	17	16	70·0	1, 18	43·0	31	0	0
XVIII		Strome Ferry.....	4·11	— ·18	·79	6	26	...	..	...	...	...	...
,,		Inverness (Culloden)	6·51	+ 3·52	1·50	8	10	70·0	18	46·0	27*f*	0	0
XIX.		Dunrobin	3·97	+ 1·12	1·44	8	13	69·0	19	44·0	27	0	...
,,		S. Ronaldsay (Roeberry).....	3·81	+ 1·45	·48	28	20	65·0	14*c*	45·0	26	0	0
XX.	IRELAND.	Dromore Castle	2·19	— 2·79	·55	4	9	75·0	12*d*	53·0	1, 23	0	...
,,		Waterford (Brook Lodge) ...	3·13	— ·40	·94	17	13	74·0	13	42·0	3	0	..
,,		O'Briensbridge (Ross)	1·13	...	·27	1	13	78·0	15	50·0	31*g*	0	0
XXI.		Carlow (Browne's Hill)	2·53	— ·99	·37	17	18	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	2·19	— ·49	·40	3	15	72·8	16	46·8	10	0	0
XXII.		Ballinasloe	1·34	— 2·21	·41	1	17	70·0	14*e*	45·0	9	0	...
,,		Clifden (Kylemore)	4·23	...	·64	1, 17	21	...	...	...	...	...	...
XXIII		Waringstown	3·09	— ·43	·43	1	19	81·0	17	45·0	9, 29	0	0
,,		Londonderry (Creggan Res.).	3·67	— ·45	·71	7	22	...	...	...	...	...	...
,,		Omagh (Edenfel)	4·29	+ ·57	1·10	2	21	73·0	15	47·0	5	0	0

a And 17. *b* And 13. *c* And 21. *d* And 14, 25. *e* And 15. *f* And 29. *g* And 30. *h* And 11, 29. *i* And 9, 28

\+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON JULY, 1891.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail. S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—After an opening week of wet, July was fairly fine and dry up to the 19th, with two hot days—the 16th and 17th. From the 19th to the close of the month was wet and cold, with a heavy TS on the 27th. T and H on the 8th; slight TS on the 21st.

ADDINGTON.—Ungenial weather for July and a great want of sunshine. The rains after the 20th were hindering for haymakers, but of great advantage to root and garden crops. Several very cold nights occurred at the end of the month. Ther. on grass 36° on 28th; T heard on 4th, 6th, 29th and 30th.

BURY ST. EDMUNDS, WESTLEY.—The usual July weather, with R on 18 days. Cold for the time of year from the 27th to the end of the month. Harvest about 10 days late. No heavy TSS; T heard on 5 days; TS on 23rd.

LANGTON HERRING.—Mean temp. at 9 a.m. 1°·9 below the average of 19 years. The fine weather from the 8th to the 16th was favourable for the hay harvest. TSS at night on 26th, 27th, and 30th. Fogs on 5th and 6th.

BODMIN.—A remarkably dry and fine month for July; most welcome showers to the 8th, and from the 17th to the 29th. Very hot on the 16th and 26th. Temp. rather high by day, but cold nights. T and L on the 26th. Fresh wind from the N.W. from the 28th to the end of the month. The crops all around are looking very good and prosperous.

STROUD.—Heavy TS to the N. from 2 p.m. until 7 p.m. on 3rd. T and L with heavy R on 29th at 2.30 p.m. and on 30th at 5 p.m.

WOOLSTASTON.—The first week was wet and stormy, a fortnight of fine summer weather followed and the last week was cold, wet and stormy, disastrous for the later hay crops. Mean. temp. 57°·6.

ORLETON.—A rather stormy month, with little good haymaking weather, except from the 8th to the 18th. The temp. rather below the average, particularly during the last week. T frequent, but no L seen during the month. Most of the R fell in heavy storms.

LEICESTER, BARKBY.—Rather awkward weather for hay getting; few intervals of any length without R. Temp. below the average except 3 days in the middle of the month. Mean. temp. 55°·3. T on 9 days.

MANCHESTER, PLYMOUTH GROVE.—Summerlike weather prevailed on the 4th and from the 14th to the 19th. The rest of the month was dull, cold and unsettled; some days as cold as winter—top coats and fires very acceptable. Mean temp 59°; the lowest in July for 24 years, excepting 1871, when it was 58°. T on 8th and 21st.

HULL, PEARSON PARK.—TS on 6th; T and L on 21st and 22nd.

WALES.

HAVERFORDWEST.—A cool fine July, the temp. only reaching or exceeding 70° on 4 days, while the max. on the 9th was only 56°·8. The days were mostly fine and clear, with small rainfalls at night. As the wind was for the most part from the N., evaporation was rapid, and consequently it was good haymaking weather. Lowest temp. on grass 39°·1 on the 11th and 13th.

SCOTLAND.

CARGEN.—Notwithstanding the mean temp. was below the average (1°·1) and the hours of sunshine were also below it, the month was very favourable for vegetation, and crops of all kinds made rapid growth. All green crops looking remarkably well at the close. Hay very short in quantity, but the crop was secured in excellent condition. Towards the end of the month the caterpillar of the diamond moth made its appearance in some of the turnip

fields in the district, and is reported to be doing considerable damage. T on 21st; T and L on 22nd.

JEDBURGH.—Much T and L on 3rd; T and L on 7th, 17th and 29th. Vegetation vigorous; the turnip and potato crops were never in finer condition, and cereals are good. There is no appearance yet in this district of the turnip caterpillar.

OBAN, CRAIGVARREN.—A very fine month with moderate R after the previous drought; green crops give good promise, but hay and straw will be very light.

MULL, QUINISH.—The R of the month was not sufficient to fill either springs or streams, and there is considerable scarcity of water in the West Highlands generally.

DUNDEE, EASTERN NECROPOLIS.—On the 22nd 1·00 in. of R fell in an hour, between 1 and 2 p.m.

BRAEMAR.—On the 21st T and L from 4 p.m. to 6 p.m.

CULLODEN.—The R was greatly in excess of the average, being the largest in July for at least 40 years.

S. RONALDSAY, ROEBERRY.—The first week wet, the second dry and warmer, but the last part of the month very wet and cold.

IRELAND.

WATERFORD, BROOK LODGE.—Mean temp. 58°·6. ·94 in. of R fell in about 2 hours on the 17th.

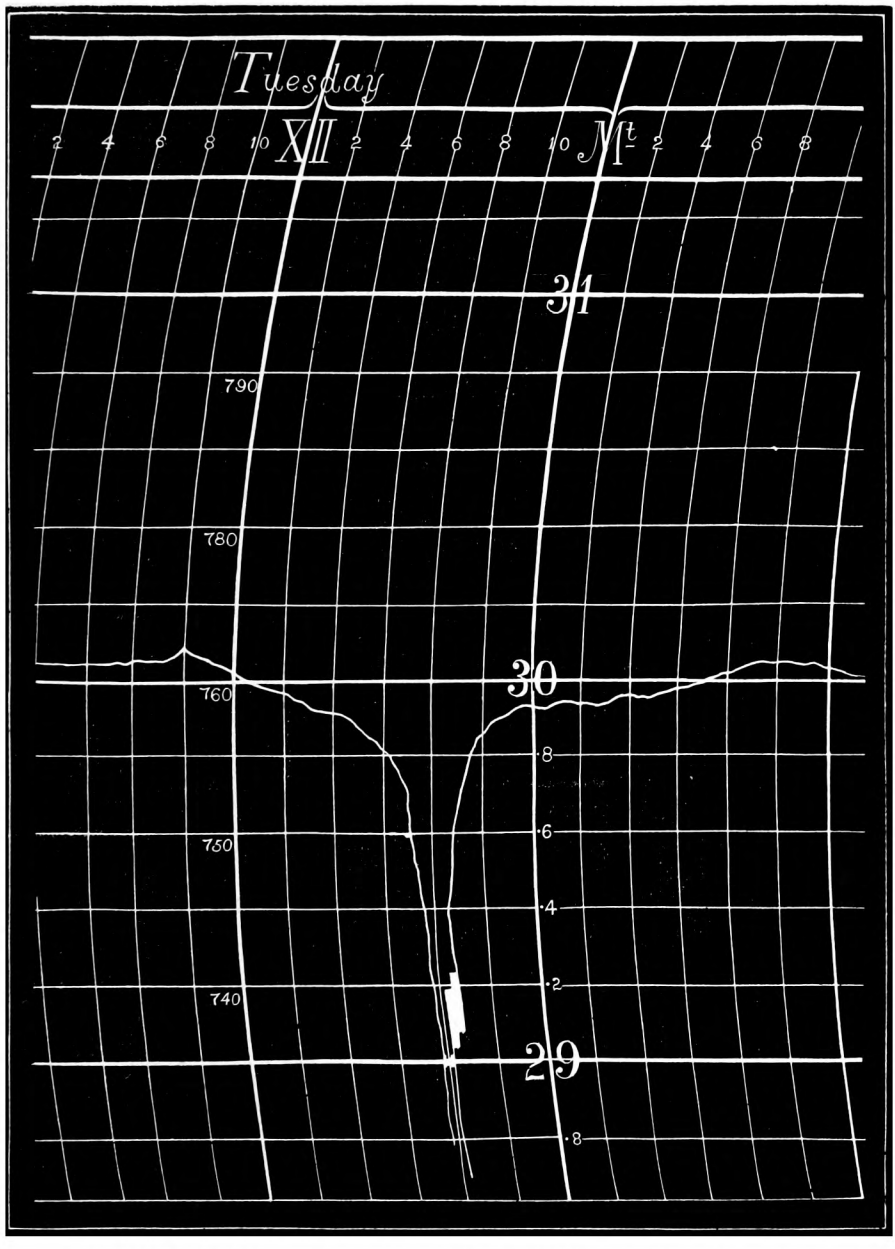
O'BRIENSBRIDGE, ROSS.—A perfect month for hay harvesting. R fell mostly at night, and the sunshine was brilliant almost every day. Mean temp. of the month lower by 3° than that of June.

DUBLIN.—A changeable, squally, showery month of average R, with a great preponderance of N.W. winds—a very common state of things in an Irish July. The mean temp 59°·0 was decidedly below the average. High winds were noted on 10 days, and attained the force of a fresh or moderate gale on two occasions, viz.: 6th and 8th. Temp. reached or exceeded 70° in the screen on only 3 days. TSS occurred on the 3rd and 26th. The R during the seven months ending July 31st, has amounted to 10·94 in. on 92 days; compared with 15·59 in. on 118 days for the same period in 1890.

WARINGSTOWN.—Great alternations of heat and cold occurred, but on the whole the month was very fine and seasonable. All crops remarkably good; oats, the heaviest crop for many years; turnips were middling in the beginning of the month, but are now promising well and the potato crop is luxuriant.

EDENFEL.—The first week was unsettled, with frequent torrential rains; the second, fine, warm and mostly clear; the third, fresh and showery, with fine intervals and the fourth, similar, accompanied by cool polar winds. On the whole the month was very favourable, a good average hay crop was saved in excellent order, and both cereal and green crops improved into the promise of an abundant harvest.

TWO MEN STRUCK BY LIGHTNING.—Two labourers, named Samuel Litten and Samuel Fox, who were employed on a farm, in the vicinity of Castle Cary, called Rat's Castle, were on Monday working in the fields near the farm. A severe thunderstorm came on, and they ran for shelter to an elm tree, beneath the branches of which they remained for a time. Unfortunately for the men the tree attracted the electric current and they were struck by the lightning. Fox was severely burned in the back, his injury having the appearance of a shot wound. Litten was fearfully burnt all down one side of his body from the shoulder. A doctor was quickly in attendance, but it is reported that when the clothes were removed from the unfortunate man the burnt flesh came off with them. There is every probability of the recovery of Fox, but in the case of Litten the prospects are much less hopeful. At Yatton a lad named Gilbert Bellamy was resting on his bicycle beneath a tree when it was struck by lightning; he was knocked over and partially stunned, but luckily sustained no further injury.—*Clevedon Mercury*, 8th August, 1891.



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AUGUST 18TH 1891.

SYMONS'S
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METEOROLOGICAL BIBLIOGRAPHY. *

Two events induce me again to consider this subject. The transfer of meteorological work in America from the Signal Service of the Army, to the Department of Agriculture, gives the *coup de grace* to the fulfilment by the Signal Service of the promise made to me by its former chief, General Hazen, that if I would let him have a copy of my catalogue of meteorological books he would undertake to print it. Relying on that promise, I sent him the originals of thousands of titles without keeping a copy, and after nearly ten years, all that anyone has, are the portions which General Greely was good enough to have type-written. However, it remains to be seen what Prof. Harrington with his splendid resources will do. All may end well, after all—for those, that is, who live long enough to see it.

The other event is the publication of the Catalogues of the Libraries of the Royal Meteorological Society and of the Deutsche Seewarte.

There are various subjects in connection with the subject in general which require consideration :—

1. *What is to be Catalogued?*—This seems to need little attention, but is really a very serious question. The 18,000 titles which I sent to America were those of books, pamphlets, or reprints from *Transactions*, &c.; with them have since been incorporated many thousand titles copied under Prof. Cleveland Abbé's direction from the Royal Society's *Catalogue of Scientific Papers*. This was the thin end of a wedge of infinite magnitude. No one appreciates more highly than I do the value of the Royal Society's *Catalogue*, but if the principle is once laid down that articles in periodicals are to be catalogued, it is difficult to see where to stop. If articles in the *Philosophical Magazine* are to be catalogued, why should not those in the *Meteorological Magazine*, in the *Zeitschrift*, in *Ciel et Terre*, &c.? and if in *Nature*, why not those in the *Times*, or the *English Mechanic*? A good illustration of the terrible way in which useful papers on meteorology are scattered is

* *Katalog der Bibliothek der Deutschen-Seewarte zu Hamburg*. Hamburg : 1890, 8vo., viii.—619 pages.

Catalogue of the Library of the Royal Meteorological Society, compiled by J. S. Harding, junr., F.R.Met.Soc. London : Stanford, 1891, 8vo., vii.—214 pages.

afforded by page 2 of the *Catalogue* of the Royal Met. Soc. If all the letters and articles which some living meteorologists have written had to be catalogued, they would, in some cases for one author, make a respectable pamphlet. Moreover, there is the question of date. The Royal Society *Catalogue*, except in rare cases, begins only with the present century; but a general meteorological bibliography should certainly be so designed as to help historians of the various branches of the science—and no one will suggest that history need not go back beyond 1800.

As all these titles of papers and articles have been got out, and *they are unquestionably useful as far as they go*, I think that they should be printed, but that it would be well by using two founts of type to indicate which are books, or reprinted articles, and which are merely references to serials.

2. *In what order should the entries be placed?*—This is a point which has been much discussed. It depends a little, but not so much as has been supposed, upon what particular use is to be made of the catalogue, and there has lately been a tendency towards having catalogues broken up into subjects; the idea being that such an arrangement facilitates research. I do not think so. There is no catalogue more handy to work with than Dr. Hellmann's *Repertorium*, yet its arrangement is primarily under authors' names. Again, the new *Catalogue* of the Roy. Met. Soc. (although it ought to have had proper head lines instead of useless ones) is, through the index at the end, a very handy work. On the contrary, the *Katalog* is grouped under subjects, and I find the publications of the Meteorological Society thus scattered:—

The Reports.—Page 10. Meteorologie-Allgemeines-Organisation und Methoden.
Modern Meteorology. — Page 27. Meteorologie Allgemeines, Lehrbucher, Geschichte, &c.
Meteorol. Record. — Page 104. Meteorologie - Geographische Meteorologie-Britische Inseln.
Proceedings.—Page 518. Zeitschriften, Veroffentlichungen von Gesellschaften.
Quarterly Journal.—Page 529. Fachzeitschriften, Englische, &c.

I am not specially complaining of the *Katalog*, though the classification is frequently very droll, and in the above case the reason for putting the *Reports* on p. 10, and the *Quarterly Journal* on p. 529, instead of along with the *Proceedings* on p. 518, is not obvious—but I do hold that all the help afforded by classification is given by such an index as that in Hellmann's *Repertorium*, or in the Roy. Met. Soc. Catalogue.

On the other hand, I think that the time and brains of the custodians of libraries merit consideration, and from that point of view the advantage of alphabetical classification under authors' names is beyond dispute. Indexes of authors' names such as those at the end of the *Katalog*, of the Belgian *Catalogue*, or of Struve's splendid *Bibliotheca*, are useless for the identification of books; one has always to turn back to the body of the work, and the labour thus thrown upon every

one whose duty it is to collect additional works for the library under his care, is immense.

Before concluding this section, I may give some illustrations of the hopelessness of trying to render subject classification a success. I had occasion recently to hunt up the original descriptions of some patterns of rain gauge. Buist's is in a volume which would be grouped under "Instructions"; Horner's and Jagga Rao's under "General Treatises"; Crosley's under "Patent Specifications" or "Instruments"; Hervé Mangon's and Stutter's under "Catalogues"; Stevenson's under "Periodicals"; Howard's under "Observations"; the Staff gauge under "Engineering" or "Water Supply"; and so on. Who would look under "Microscope" for an early article on Snow Crystals—as will be found in Hooke's Micrographia—or suppose that *Good Words* contained a thorough discussion of the influence of the full moon upon the amount of cloud.

It may be urged that classification under authors' names will lead to difficulties with reference to series of observations at public observatories. I think that it would, but surely that would be perfectly met by entering the observations under the name of the town, and the observer in his alphabetical position, with a cross reference to the town; we should thus have Pond, Airy, Christie, each in his proper place, each referring to Greenwich, where the publications would be entered in a continuous series.

There is one point not yet dealt with—a minor one, but worthy of consideration. Assuming, as I hope I may, that our Trans-Atlantic friends print the magnificent materials which they have obtained, and that they revert, as I hope they will, to the alphabetical order in which the cards were sent to them, there will still be the entering in the subject index to arrange. Should the entries therein run alphabetically or chronologically? I think that the latter is preferable, because it is by far the more handy for the historian—the work of chronological classification would be done once for all. This seems far to outweigh the slight advantage which the alphabetical arrangement affords for finding whether any particular person has written on any particular subject—which can be ascertained in two other ways —from the index if the date at which he lived is known, or from the body of the catalogue by running down the list of his works.

Turning, in conclusion, to the two catalogues, in order to infer therefrom the character and relative strength of the two libraries, I find it hopeless to make any strict comparison, partly because the two differ radically in their arrangement, and partly because the alphabetical index to the *Katalog* is incomplete. My impression is that the two libraries differ considerably, that the London one is the richer as regards old works (though even it is far behind that of the Société Météorologique de France), and that the Hamburgh one is the richer in series of observations. The *Katalog* is by far the larger book, but it contains hundreds of titles of works which have nothing to do with meteorology; in fact the library would

have been improved had it been weeded, as was that of the Royal Meteorological Society, *e.g.*, what does the Seewarte want with such books as:

CLIFFORD, Thomas, Specification of the Patent granted to Mr. ——, of the City of Bristol, Merchant; for his Invention of an entire new Mode of manufactnring Nails of every kind, by Machinery never before made use of for that purpose. (Dated Juli 17, 1791.) (Aus: Repertory of Arts and Manufactures, Vol. VII. Number XL.) (S. 5622.)

CUMMINGS, George, Specification of the Patent granted to Mr. ——, of Ludgate-street, London, Toiman; for his Invention of a Composition to put on all Sorts of Skins, Paper or Linen, for drawing or writing on with Pen and Ink, or Pencil, and rubbing clean off again. (Dated March 31, 1764.—Term expired.) (Aus: Repert. of Arts and Manufact., Vol. VII, Nr. XL.) (S. 5622.)

I am well aware of the difficulty of defining the sizes of books, fo. 4to., 8vo., &c., and have doubtless myself made many errors of that kind, but I am not sure that Dr. Neumayer decided wisely when he resolved that the *Katalog* should give no indication whatever as to size. As long as the present infinite variety of size of sheet prevails, there will be mistakes of 4to. for 8vo., and of 8vo. for 12mo., but I think that it is better to put up with a few such errors than to give no information at all.

Similarly, I wish that the Catalogue of the Royal Meteorological Society had been arranged in one alphabet instead of in seven sections.

But it is only when a work is completed that one can consider it as a whole. Success is the result of experience—even failures are useful as lessons—and I am not going to class either of these Catalogues as a failure. On the contrary, each is useful, and if their publication and this article, lead to further consideration of the whole subject, and to the issue in a workable form of the American Bibliography of Meteorology (in which doubtless the contents of each of the volumes before us would be incorporated), we should have a series of volumes of unique value to meteorological thinkers.

In conclusion, I invite any one who does not agree with the above views to state his objections. All meteorologists are interested in this work being done in the very best manner, and the more thoroughly the arrangements are discussed beforehand the better.

G. J. S.

A RAINY AUGUST.

THE exceptional character of the rainfall of the past month induces us to offer to our readers details which are themselves a remarkable proof of the zeal and accuracy of our observers. It says something for the organization that without a single special letter or circular, we have received full details, not merely from the 150 correspondents

whose results we give every month, but from a nearly equal number of others. To have received, verified, and sent through the press within a fortnight after its close the reports of nearly 300 observers on an exceptional month, speaks well for the observers and the organization in general.

It may be thought that by giving abstracts of all these returns we are overdoing the subject, but if anyone will take the trouble to mark all the stations on a large map, he will find that, large as is the number, the cases of stations within several miles of the next nearest are rare, except in the English lakes, and there the fall has been so enormous, that all the details are of great interest The observer who takes the gauges on Sca Fell and on some other mountains and those on the Stye, unfortunately took them two days too soon, so that his Augusts are too small, and his Septembers will be too large. We must, therefore, leave those figures out, and so Seathwaite is at the head of the list with 26·99 in., followed by Buttermere with 23·37 in., Borrowdale Vicarage with 22·25 in., and Mardale Haweswater with 20·20 in., and these again by upwards of twenty stations with totals between 10 in. and 20 in. Two stations in North Wales will be seen to have had 18·50 in. and 20·98 in. respectively.

In the special table on pages 118 and 119 we have given values which (subject to one correction) indicate well the areas of greatest excess. We refer to the column giving the ratio of the total fall in August, 1891, to the mean of August, 1880-89. From this it will be seen, for instance, that in London the fall was $2\frac{1}{2}$ times the average, at several stations 3 times the average, and at Seathwaite nearly $3\frac{1}{4}$ times the average. On the other hand, at Maidstone, Cheadle, Haverfordwest and Dublin, it was but a trifle above the average.

The correction above mentioned is that due to ten years being too short a period to give a trustworthy mean monthly fall. At most stations the mean for August, 1880-89 is lower than the true mean for a long period.

It does not seem desirable to try to epitomize the notes of the observers, but to refer readers to them. They will find therein many very interesting facts, especially with reference to the enormous fall on August 24th and 25th, ranging in the 48 hours, from 10·24 in. through 9·16 in., 8·25 in., 7·57 in. down to 5 inches, which seems to have prevailed as an average over at least 300 square miles in the English Lake district, but this must be worked out thoroughly in *British Rainfall*, 1891.

In order to ensure continuity, we leave the regular tables in their usual form ; and in the special table on the following pages repeat the values for some of these stations, with the addition of the last two columns, which have been specially calculated in illustration of the exceptional character of the fall, and lastly we give in a list of notes an epitome of much that has come to us in various forms, but all sorted geographically in the order that the stations hold in *British Rainfall*

Relation of Rainfall in August, 1891, to the Mean 1880-89.

STATION.	COUNTY.	August, 1891.		Ratio to Mean 1880-89.	Max. 1880-90.
		Depth.	Days.		
		in.			in.
Camden Square	Middlesex	4·75	22	2·5	4·89
Pinner Hill	,,	4·16	21	2·2	4·28
Guildford	Surrey	4·05	21	2·7	4·23
Maidstone	Kent	3·03	20	1·8	3·57
Steyning	Sussex	6·57	16	2·9	5·87
Ashdell, Alton	Hants	6·02	23	2·7	5·91
Strathfield Turgiss	,,	3·81	26	2·2	5·38
Addington, Winslow	Bucks	4·96	23	2·5	4·75
Magdalen College	Oxford	4·51	23	2·5	4·64
Bloxham, Banbury	,,	4·61	21	2·2	5·33
Castle Ashby	Northampton	4·61	22	2·1	4·28
Woodford	Essex	5·23	23	2·6	4·52
Sheering, Harlow	,,	3·87	25	2·0	4·89
Saffron Walden	,,	3·77	25	1·8	4·64
Diss	Norfolk	3·68	21	1·8	4·73
Swaffham	,,	4·25	23	1·5	4·52
Salisbury	Wilts	5·34	22	3·0	5·96
Devizes	,,	7·25	24	3·1	5·42
Okehampton	Devon	8·37	22	2·7	6·14
Barnstaple	,,	6·08	21	2·1	5·86
Lynmouth	,,	7·46	24	2·5	5·84
Probus	Cornwall	6·29	19	2·5	5·26
Bodmin	,,	8 31	26	2·9	4·87
Wells	Somerset	6·74	23	2·7	5·34
Clifton	Gloucester	7·44	22	2·5	5·64
Ross	Hereford	4·90	24	2·4	4·77
Cheadle	Stafford	4·89	25	1·6	5·81
Tenbury	Worcester	4·01	21	1·9	3·88
Coventry	Warwick	4·04	20	1·7	5·61
Barkby	Leicester	3·27	23	1·3	5·09
Boston	Lincoln	2·77	20	1·3	4·32
Horncastle	,,	3·16	24	1·2	4·57
Hesley Hall	Notts	3·29	20	1·5	5·36
Neston	Cheshire	4·96	24	2·0	4·46
Walton, Liverpool	Lancashire	5·79	20	2·1	5·51
Manchester	,,	6·13	23	2·0	6·00
Darwen	,,	9·75	25	2·6	6·68
Wetherby	Yorks	3·20	14	1·4	4·96
Arncliffe	,,	9·18	26	2·1	7·21
Ripon	,,	4·08	24	1·6	6·03
Hull	,,	3·79	22	1·4	6·45
East Layton	,,	4·14	21	1·7	6·96
Mickleton	,,	5·74	22	2·4	6·46
Haltwhistle	Northumberland	5·48	20	1·9	6·54
Newcastle	,,	4·80	20	1·8	6·22
Seathwaite	Cumberland	26·99	28	3·2	13·53
Llandovery	Carmarthen	8·77	29	2·4	6·64
Haverfordwest	Pembroke	6·11	20	1·9	5·59
Rhayader	Radnor	7·38	26	1·7	7·08
Llandudno	Carnarvon	4·19	16	1·8	4·92
Douglas	Isle of Man	7·56	23	2·6	5·32
Cargen	Kirkcudbright	8·41	22	2·9	4·59
Jedburgh	Roxburgh	4·93	21	2·2	5·86

STATION.	COUNTY.	August, 1891.		Ratio to Mean 1880-89.	Max. 1880-90.
		Depth.	Days.		
		in.			in.
Old Cumnock	Ayr	6·39	27	1·9	5·65
Glasgow	Renfrew	4·52	19	1·7	4·35
Lochgilphead	Argyll	6·72	23	1·5	6·54
Appin	,,	6·45	...	1·4	6·91
Loch Leven	Kinross	6·20	...	2·1	5·60
Dalnaspidal	Perth	5·32	27	1·3	7·81
Dundee	Forfar	4·35	16	1·7	6·50
Braemar	Aberdeen	5·18	23	1·6	7·57
Keith	Banff	5·34	27	1·8	5·89
Strome Ferry	Ross	6·56	25	1·4	7·74
Cawdor	Inverness	3·13	22	1·4	5·12
Scourie	Sutherland	5·63	20	1·8	6·14
Dromore	Kerry	6·24	23	1·3	8·63
Fermoy	Cork	4·28	17	...	5·20
Brook Lodge	Waterford	7·10	23	2·1	6·52
Derry Castle	Tipperary	10·36	29	2·5	6·60
Ennis	Clare	7·82	26	2·2	5·41
Miltown Malbay	,,	9·36	29	2·3	6·64
Browne's Hill	Carlow	5·54	25	1·9	5·13
Dublin	Dublin	4·95	25	1·9	5·75
Athlone	Westmeath	7·67	27	2·1	5·95
Queen's College	Galway	7·28	26	1·9	5·50
Ballinasloe	,,	6·82	24	2·1	4·48
Crossmolina	Mayo	6·54	28	1·5	7·02
Seaforde	Down	5·87	21	2·1	5·55
Waringstown	,,	6·04	29	1·9	7·29
Belfast	Antrim	5·86	26	1·4	7·98
Creggan Res.	Londonderry	6·07	27	1·5	7·95
Omagh	Tyrone	7·45	27	2·1	5·69

NOTES.

Mount View Road, Stroud Green, N.—R 5·48 in.—*G. J. Gwilliam.*

Muswell Hill, Middlesex.—R 4·96 in. on 23 days, greatest in August since 1879.—*S. G. Abethell.*

Etchingham Park, Finchley.—R 4·81 in. on 23 days.—*J. W. Scott.*

Hazelhurst, Haslemere.—R 6·33 in. on 26 days; R every day after 16th; 1·90 in. between 3 p.m. on 20th and 8 a.m. on 21st.—*T. P. Newman.*

Holmfels, Reigate, Surrey.—R 4·36 in. on 22 days.—*F. P. Baker.*

Wallington, Surrey.—R 4·82 in. on 25 days; sunlight very deficient.—*F. C. Bayard.*

Hythe, Kent.—R 4·04 in. on 22 days.—*H. B. Mackeson.*

Walmer, Kent.—R 3·09 in. on 18 days.—*H. R. L. Botting.*

Camden Park, Tunbridge Wells.—R 4·59 in. on 25 days, more than double the average of the previous 7 years.—*J. Weston.*

RIVERHEAD, SEVENOAKS.—R 3·68 in. on 23 days.—*J. B. Murdoch.*

KESTON TOWER, KENT.—R 4·72 in. on 21 days; not one hot day.—*G. Buchanan.*

LEYSDOWN, SHEPPEY.—R 2·34 in. on 21 days; wet and stormy, with little sunshine.—*A. Farbrother.*

ST. LAWRENCE, VENTNOR, I.W.—R 4·74 in.—*W. E. Kilburn.*

WATER WORKS OFFICE, VENTNOR.—R 5·29 in. on 22 days.

HEADLEY, HANTS.—R 5·34 in.—*A. F. Parbury.*

NEWBURY, BERKS.—R 5·37 in. on 24 days, daily after 16th.—*W. J. Cowper.*

WESTON, BERKS.—R 6·11 in.—*R. Osmond.*

TWYFORD, BERKS.—R 5·00 in. on 24 days; very wet and cold.—*E. Finch.*

FARINGDON, BERKS.—R 4·96 in. on 24 days.—*W. Dundas.*

BUNTINGFORD, HERTS.—R 3·55 in. on 23 days.—*A. E. Morse.*

BROXBOURNE, HERTS.—R 4·07 in. on 23 days.—*G. J. Newbery.*

GREAT MARLOW, BUCKS.—Comparative values for 1879 and 1891:

	Depth.				Days.			
	1879.		1891.		1879.		1891.	
	in.		in.					
June.....	5·25	17·25 in.	2·39	11·44 in.	19	50	9	46
July.....	4·62		3·73		16		17	
August	7·38		5·32		15		20	

J. Ford.

PETERBOROUGH INFIRMARY, NORTHAMPTON.—R 3·20 in.—*A.F.R. Platt.*

ALCONBURY, HUNTINGDON.—R 4·11 in. on 21 days.—*R. Conway.*

WOODBRIDGE, SUFFOLK.—R 3·40 in. on 22 days; harvest much injured.—*W. Page Phillips.*

RUSHALL, HARLESTON.—R 4·39 in. on 22 days.—*C. Gape.*

WYMONDHAM, NORFOLK.—R 3·72 in. on 23 days.—*E. B. Pomeroy.*

DENVER, NORFOLK.—R 3·78 in. on 21 days: very wet and stormy; corn beaten down and hay spoilt.—*J. M. DuPort.*

BISHOPS CANNINGS, DEVIZES.—R 7·25 in.; the greatest previously recorded was 7·11 in. in October, 1875.—*C. W. Hony.*

THE PRIORY, MALMESBURY, WILTS.—R 7·05 in. on 21 days.—*Alfred W. Chubb.*

HAZELBURY BRYAN, DORSET.—R 9·07 in. on 18 days; great damage to crops.—*R. F. Wheeler.*

DRUID, ASHBURTON, DEVON.—R 8·55 in. on 22 days.—*F. Amery.*

NIDDERDALE, EXMOUTH.—R 5·22 in. on 22 days.—*Herbert Stewart.*

IVEDON, HONITON.—R 5·42 in. on 23 days.—*E. Stanley.*

HEALE HOUSE, LITTLEHAM, BIDEFORD.—R 7·67 in. on 21 days; August average for 15 years is 3·51 in., and the highest previously was 5·79 in. in 1879.—*R. Sanders.*

HARTLAND ABBEY, DEVON.—R 7·03 in. on 21 days.—*G. Sleep.*

MORVAH, CORNWALL.—R 7·90 in.—*J. H. Thomas.*

WELLS, SOMERSET.—R 6·74 in. on 23 days.—*R. J. Manning.*

WESTON-SUPER-MARE.—R 7·17 in. on 23 days, unusually cold and wet.—*H. Alford.*

ALMONDSBURY, GLOUCESTER.—R 7·09 in. on 24 days.—*C. O. Miles.*

LLANTHONY LOCK, GLOUCESTER.—R 5·50 in. on 18 days.—*H. J. Marten.*

MAISEMORE LOCK, GLOUCESTER.—R 5·49 in. on 25 days.—*H. J. Marten.*

HEATH LODGE, CHELTENHAM.—R 4·80 in. on 23 days.—*M. A. Smelt.*

SOUTHAM VILLA, CHELTENHAM.—R 4·86 in. on 22 days.—*R. Tyrer.*

UPPER LODE, TEWKESBURY.—R 4·67 in. on 22 days.—*H. J. Marten.*

ROSS, HEREFORD.—R 4·90 in., greatest in August since 1879 (5·78 in.)—*H. Southall.*

BURWARTON, SALOP.—R 4·94 in. on 24 days.—*A. James.*

HOAR CROSS, BURTON, STAFFORD.—R 4·12 in. on 19 days.—*F. W. Lycett.*

BEVERE LOCK, WORCESTER.—R 3·43 in. on 22 days.—*H. J. Marten.*

HOLT LOCK, DROITWICH.—R 3·80 in. on 21 days.—*H. J. Marten.*

LINCOMB, STOURPORT.—R 4·15 in. on 20 days.—*H. J. Marten.*

BEDWORTH, WARWICKSHIRE.—R 3·54 in. on 16 days.—*D. Bosworth.*

ROTHERBY HALL, LEICESTERSHIRE.—R 3·83 in. on 25 days; weather very wet and cold.—*J. Hames.*

HEMINGBY, HORNCASTLE.—R 3·90 in. on 21 days.—*E. S. Bengough.*

APPLEBY, BRIGG, LINCOLN.—R 4·68 in. *A. E. Brown Constable.*

WILLINGTON, DERBY.—R 3·44 in. on 22 days.—*G. A. Smallwood.*

MIDLAND RAILWAY, DERBY.—R 3·55 in. on 21 days.—*W. Langdon.*

DUNSDALE, FRODSHAM, CHESHIRE.—R 4·03 in. on 21 days.—*J. Simpson.*

TRAINING COLLEGE, WARRINGTON.—R 4·81 in. on 22 days.—*J. Feniman.*

WITHINGTON, LANCASHIRE.—R 5·50 in. on 20 days; this is less than in 1889, when 5·69 in. fell.—*J. King, jr.*

THE PARK, BOLTON.—R 8·18 in. on 25 days; this is 3·22 in. above the average.—*W. W. Midgley.*

DARWEN. –R 9·75 in. on 25 days; the most yet recorded in any month.—*W. H. Blamire.*

HAIGHTON, PRESTON.—R 9·89 in. on 28 days.—*J. J. Myres.*

ELSWICK LODGE, ECCLESTON.—R 9·54 in., being more than double the average for 19 years, and within 0·84 in. of equal to the total of the previous seven months. Previously we have only once had more than 7 in., viz., 7·19 in. in August, 1881.—*S. King.*

BARNSFOLD, BEATON FELL.—R 10·27 in. on 28 days; monthly gauge gave 10·25 in.—*J. J. Myres.*

CALDER MOUNT, GARSTANG.—R 9·63 in.; previously the wettest month for at least 24 years was September, 1872, 9·51 in.—*Sydney Wilson.*

LANCASTER.—R 11·47 in. on 29 days; the total for the previous seven months was only 11·56 in., so that August alone nearly equalled them. The largest daily fall previously recorded was 2·25 in. on October 6th, 1874; but on August, 24th, 1891, we had 2·30 in., and on the next day 2·38 in.—*W. O. Roper.*

ESTHWAITE LODGE, HAWKSHEAD.—R 13·30 in. on 26 days; between 3 p.m. on 24th and 9 p.m. on 25th—*i.e.*, in 30 hours—4·48 in. fell, and 5·17 in. in the 48 hours ending 9 a.m. on 26th.—*W. Alcock-Beck.*

SEATHWAITE VICARAGE, DUDDON VALLEY.—R 16·39 in. on 26 days; the wettest for many years; five days with more than an inch upon each; the 24th gave 2·94 in. and the 25th 2·99 in., or 5·93 in. in 48 hours.—*S. R. M. Walker.*

MONK CONISTON PARK.—R 14·29 in. on 23 days.—*S. A. Marshall.*

BLACK FELL, HAWKSHEAD.—R 13·55 in.—*S. A. Marshall.*

SKELWITH FOLD, AMBLESIDE.—R 14·65 in. on 26 days.—*S. A. Marshall.*

CHERRY BANK, ILKLEY, YORKS.—R 5·51 in.—*H. Richardson.*

BRIGFLATTS, SEDBERGH, YORKS.—R 13·51 in. on 26 days; 3·11 in. on 24th, and 2·18 in. on 25th.—*J. Handley.*

HOUGHTON, MARKET WEIGHTON.—R 3·69 in.—*J. Wells.*

NORTON, MALTON.—R 4·41 in. on 20 days; crops damaged.—*E. K. Spiegelhalber.*

INGLEBY GREENHOW, YORKS.—R 4·71 in. on 24 days.—*J. Hawell.*

WHORLTON, BARNARD CASTLE, DURHAM.—R 4·04 in. on 22 days.—*F. A. Dodgson.*

BINGFIELD, NORTHUMBERLAND.—R 5·47 in.; only previously equalled in August since 1876 by 1877, 7·89 in.; 1881, 5·70 in.; and 1890, 5·75 in.—*J. Coppin.*

CHATTON, BELFORD.—R 4·18 in. on 26 days.—*R. Bell.*

LEYFIELD, MILLOM, CUMBERLAND.—R 8·46 in.; very wet month, harvest spoiling.—*C. Vaughan.*

ULPHA VICARAGE, DUDDON VALLEY.—R 14·39 in. on 25 days; 5·07 in. in 48 hours to 9 a.m. on 26th.—*W. Kewley.*

ESKDALE.—R 14·06 in. on 27 days.—*R. Herbert Snape.*

NETHER WASDALE.—R 10·34 in. on 24 days, all agricultural work much impeded.—*J. Baker.*

BORROWDALE VICARAGE.—R 22·25 in. on 27 days; 8·26 in. in 48 hours ending 9 a.m. 26th.—*J. Taylor.*

HASSNESS, BUTTERMERE.—R 23·37 in. on 29 days; 9·16 in. in 48 hours ending 9 a.m. 26th.—*S. Stewart.*

GRANGE, BORROWDALE.—R 18·88 in. on 26 days; 7·57 in. in 48 hours ending 9 a.m. 26th.—*J. Threlkeld.*

HALLSTEADS, ULLSWATER.—R 9·67 in.—*S. A. Marshall.*

DERWENT ISLAND, KESWICK.—R 12·28 in. on 28 days.—*S. A. Marshall.*

THE BEECHES, KESWICK.—R 12·18 in. on 26 days; cold and rainy.—*T. Paulin.*

MELMERBY, KIRKOSWALD.—R 6·78 in. on 25 days.—*A. C. Pittar.*

ULDALE, MEALSGATE.—R 9·55 in. on 20 days.—*J. Greenwood.*

NOOK COTTAGE, AMBLESIDE.—R 14·77 in., or nearly three times the average.—*E. Hird.*

KIRKSTONE PASS, AMBLESIDE.—R 12·82 in. on 28 days.—*P. M. Dixon.*

MARDALE, HAWESWATER.—R 20·20 in.—*N. M. Sargeant.*

PATTERDALE, ULLSWATER.—R 15·87 in. on 27 days.—*S. A. Marshall.*

SWARTHFELL, ULLSWATER.—R 10·30 in.—*E. Bardgett.*

BARTON HALL, PENRITH.—R 7·80 in.—*J. H. Cumpston.*

THE HENDRE, MONMOUTH.—R 6·20 in. on 21 days.—*T. Coomber.*

LLANVIHANGEL COURT, ABERGAVENNY.—R 5·31 in. on 21 days; cereals very backward and much damaged.—*N. G. Sturt.*

SKETTY, SWANSEA.—R 8·02 in.; exceptionally wet.—*T. Travers Wood.*

PENTY PARK, PEMBROKE.—R 6·24 in. on 19 days.—*F. L. Lloyd Philipps.*

EDNOL, NEW RADNOR.—R 6·10 in. on 23 days—*W. Jones.*

CLATTERBRUNE, PRESTEIGN.—R 5·59 in. on 21 days.—*J. Winfield.*

LAKE VYRNWY, MONTGOMERY.—R 9·34 in. on 25 days.—*H. J. Marten.*

RHIWBRIFDIR, MERIONETH.—R 18·50 in. on 22 days.—*R. Roberts.*

GLYN PADARN, LLANBERIS, CARNARVON.—R 20·98 in. on 22 days; 3·42 in. on 24th, and 3·05 in. on 25th, or 6·47 in. in the two days.—*F. Muckleton-Allen.*

GOREBRIDGE, EDINBURGH.—R 6·84 in. on 25 days.—*L. A. Anstruther.*

BLACKET PLACE, EDINBURGH.—R 5·21 in. on 25 days; very bad for farmers.—*R. C. Mossman.*

INVERARY, ARGYLL.—R 7·21 in. on 26 days.—*D. Little.*

AIRDS, ARGYLL.—R 6·45 in.—*A. M. Lachlan.*

DRIMNIN, MORVERN, ARGYLL.—R 6·20 in. on 24 days.—*M. J. Gordon.*

WICK, H.R.S., CAITHNESS.—R 4·53 in. on 13 days.—*D. Macgregor.*

HURDLESTOWN, CLARE.—R 8·44 in. on 27 days; this is just double the average for August, and the greatest in any month for seven years. All cut hay is rotten, and the corn is in a bad state.—*W. Bentley.*

WOODLAWN, GALWAY.—R 8·66 in. on 25 days.—*A. Porter.*

AGOLAGH, ANTRIM.—R 4·09 in. on 21 days.—*S. A. Brenan.*

CARRABLAGH, LOCH SWILLY, DONEGAL.—R 6·65 in. on 27 days; cold, wet and unseasonable.—*H. C. Hart.*

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, FEB., 1891.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	61·2	28	24·2	23	46·0	32·5	35·2	89	83·8	19·7	·01	1	5·9
Malta	61·5	27	37·7	20	56·0	44·5	41·6	79	127·8	33·9	3·80	12	5·7
Cape of Good Hope	86·1	28	50·2	21	75·4	57·6	...	...	...	...	1·01	9	...
Mauritius	86·0	4	69·0	19	83·1	74·2	70·6	79	136·7	63·3	4·32	19	6·2
Calcutta	87·1	28	46·2	7	80·7	58·4	57·2	67	145·2	37·5	·91	3	2·2
Bombay	87·7	15	58·5	9	82·3	66·9	61·7	65	135·9	43·4	·00	0	0·7
Ceylon, Colombo	91·1	10	68·3	1	86·9	72·5	70·3	76	148·0	58·0	2·81	12	3·7
Melbourne	100·6	14	45·0	6	75·4	53·7	49·6	61	148·5	30·9	·37	4	4·2
Adelaide	102·7	8	50·0	16	82·9	58·8	48·8	46	159·9	40·1	·08	2	1·6
Tasmania, Hobart	91·0	9	42·7	23	68·6	51·2	49·4	67	143·0	37·5	·75	12	6·7
Wellington	79·0	11	47·5	16	68·2	54·3	57·3	88	135·0	39·0	4·42	13	4·2
Auckland	80·0	1	56·5	25	74·5	60·9	58·5	72	143·0	44·0	9·17	10	6·0
Jamaica, Kingston	90·2	1	63·6	5	86·7	66·9	64·4	67	...	...	·27	...	...
Trinidad	90·0	1	63·0	5	85·3	67·4	67·6	73	155·0	57·0	·92	11	...
Toronto	49·0	25	2·1	4	34·8	20·8	24·0	79	...	—1·5	2·65	19	6·6
New Brunswick, Fredericton	49·5	25	—14·2	20	28·9	3·6	14·5	73	...	...	3·55	13	6·2
Manitoba, Winnipeg	24·0	6	—34·5	1	5·6	—18·5	—3·9	99	...	...	·88	12	4·7
British Columbia, Esquimalt	45·0	19	23·1	16	38·6	29·3	30·6	87	...	...	2·62	19	7·0

FEBRUARY, 1891. REMARKS.

MALTA.—Mean temp. 49°·5; mean hourly velocity of wind 10·5 miles. Sea temp. rose from 56°·8 to 58°·0. L on 11th and 14th; H on 8th and 19th. A violent gale from N.E. on 15th averaged 32 miles per hour for 24 hours, and caused great damage in the harbour. J. SCOLES.

Mauritius.—Mean temp. of air 0°·1 below, of dew point 0°·6 above, and rainfall 1·78 in. below, their respective averages. Mean hourly velocity of wind 11·5 miles, or 0·3 above the average; extremes, 40·0 on 6th and 1·7 on 2nd; prevailing direction S.E. by E. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—L was seen on the 5th, 6th, 7th and 8th.
J. C. H. CLARKE, Lieut.-Col., R.E.

Melbourne.—Mean temp. of air 1°·7, of dew point 3°·6, humidity 5, cloud 1·1, and rainfall 1·55 in., below their respective averages. Prevailing wind S. Hot wind on 14th. Heavy dew on 8 days. L on 21st. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 3°·0, and rainfall ·60 in., below the average of 34 years. A very large number of clear days (15), and mean amount of cloud at 9 p.m. only 0·8.
C. TODD, F.R.S.

Wellington.—Showery during the first few days with strong N.W. wind, then fine weather with S.E. wind till 12th, when R commenced and continued to evening of the 14th, 1·70 in. falling on the 13th. The remainder of the month was fine, with occasional showers; wind chiefly southerly. Some very warm weather at times. L on night of 28th. Mean temp. 1°·3 below, and rainfall ·87 in. below, the average. R. B. GORE.

Auckland.—A rainy and unsettled month, the total rainfall being nearly three times the average—the remarkable fall of 4·02 in. being registered on the 22nd.
T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL, AUGUST, 1891.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in			in.
II.	Dorking, Abinger Hall.	5·85	XI.	Builth, Llanwrtyd Wells	9·25
,,	Margate, Birchington...	...	,,	Rhayader, Nantgwillt..	7·38
,,	Brighton, PrestonvilleRd	5·12	,,	Corwen, Rhug	4·57
,,	Hailsham	7·53	,,	Carnarvon, Cocksidia ...	6·00
,,	Ryde, Thornbrough	6·80	,,	I. of Man, Douglas	7·56
,,	Alton, Ashdell.....	6·02	XII.	Stoneykirk, Ardwell Ho.	6·74
III.	Oxford, Magdalen Col...	4·51	,,	New Galloway, Glenlee	6·68
,,	Banbury, Bloxham	4·61	,,	Melrose, Abbey Gate...	5·63
,,	Northampton	3·25	XIII.	N. Esk Res. [Penicuick]	6·60
,,	Cambridge, Fulbourne..	4·82	XIV.	Ballantrae, Glendrishaig	6·39
,,	Wisbech, Bank House..	3·90	,,	Glasgow, Queen's Park.	4·52
IV.	Southend	2·67	XV.	Islay, Gruinart School..	7·13
,,	Harlow, Sheering	3·87	XVI.	Dollar.....	4·97
,,	Rendlesham Hall	3·66	,,	Balquhidder, Stronvar..	8·08
,,	Diss	3·68	,,	Coupar Angus Station..	4·82
,,	Swaffham	4·25	,,	Dunkeld, Inver Braan..	6·57
V.	Salisbury, Alderbury...	5·34	,,	Dalnaspidal H.R.S. ...	5·32
,,	Warminster	...	XVII.	Keith H.R.S.	5·34
,,	Bishop's Cannings	7·25	,,	Forres H.R.S.	2·45
,,	Ashburton, Holne Vic....	10·64	XVIII.	Fearn, Lower Pitkerrie.	2·96
,,	Okehampton, Oaklands.	8·37	,,	Loch Shiel, Glenaladale	11·24
,,	Lynmouth, Glenthorne.	7·46	,,	N. Uist. Loch Maddy ...	3·78
,,	Probus, Lamellyn	6·29	,,	Invergarry	6·55
,,	Launceston, S. Petherwin	...	,,	Aviemore H.R.S.	3·92
,,	Wincanton, Stowell Rec.	5·52	,,	Loch Ness, Drumnadrochit	3·42
,,	Wells, Westbury.....	...	XIX.	Lairg H.R.S.	...
VI.	Bristol, Clifton	7·44	,,	Scourie	5·63
,,	Ross, the Graig	4·90	,,	Watten H.R.S.	4·46
,,	Wem, Clive Vicarage ...	4·70	XX.	Dunmanway, Coolkelure	8·90
,,	Cheadle, The Heath Ho.	4·89	,,	Fermoy, Gas Works ...	4·28
,,	Worcester, Diglis Lock	3·75	,,	Darrynane Abbey.....	5·52
,,	Coventry, Coundon.....	4·04	,,	Tipperary, Henry Street	5·94
VII.	Ketton Hall [Stamford]	3·40	,,	Limerick, Kilcornan ...	6·21
,,	Grantham, Stainby	4·06	,,	Ennis	7·82
,,	Horncastle, Bucknall ...	3·16	,,	Miltown Malbay.....	9·36
,,	Worksop, Hodsck Priory	3·11	XXI.	Gorey, Courtown House	5·57
VIII.	Neston, Hinderton	4·96	,,	Mullingar, Belvedere ...	7·69
,,	Knutsford, Heathside...	5·54	,,	Athlone, Twyford	7·67
,,	Lancaster, Eadenbeck...	11·47	,,	Longford, Currygrane...	...
,,	Broughton-in-Furness..	10·38	XXII.	Galway, Queen's Coll...	7·28
IX.	Ripon, Mickley	4·08	,,	Crossmolina, Enniscoe..	6·54
,,	Scarborough, West Bank	4·14	,,	Collooney, Markree Obs.	7·14
,,	East Layton [Darlington]	4·14	,,	Ballinamore, Lawderdale	7·11
,,	Middleton, Mickleton..	5·74	,,	Lough Sheelin, Arley ..	7·38
X.	Haltwhistle, Unthank..	5·48	XXIII.	Warrenpoint	5·75
,,	Bamburgh.....	3·92	,,	Seaforde	5·87
,,	Shap, Copy Hill	...	,,	Belfast, New Barnsley..	5·86
XI.	Llanfrechfa Grange	8·75	,,	Bushmills, Dundarave...	5·75
,,	Llandovery	8·77	,,	Stewartstown	5·39
,,	Castle Malgwyn	4·49	,,	Buncrana	5·23

AUGUST, 1891.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average. 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date	No. of Nights below 32° In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	4·75	+ 2·87	1·44	20	22	75·8	14	43·2	30	0	0
II.		Maidstone (Hunton Court)...	3·03	+ 1·34	·82	20	20	...	...	...	...	...	...
,,		Strathfield Turgiss	3·81	+ 2·10	1·14	20	26	77·3	14	43·1	4	0	0
III.		Hitchin	3·42	+ 1·60	1·39	20	25	79·0	14	39·0	30	0	0
,,		Winslow (Addington)	4·96	+ 2·99	1·20	20	23	76·0	14	37·0	30	0	0
IV.		Bury St. Edmunds (Westley)	3·77	+ 1·57	·95	20	20	...	...	...	...	...	...
,,		Norwich (Cossey)	3·46	...	·80	20	22	...	...	...	...	...	...
V.		Weymouth(LangtonHerring)	5·68	+ 3·75	1·78	20	21	69·0	13*b*	47·0	30	0	0
,,		Barnstaple	6·08	+ 3·12	1·14	28	21	68·0	6, 14	42·0	30	0	...
,,		Bodmin (Fore Street)	8·31	+ 5·46	1·54	20	26	...	...	...	...	...	...
VI.		Stroud (Upfield)	6·65	+ 4·56	1·51	27	23	77·0	14	43·0	29	0	0
,,		ChurchStretton(Woolstaston)	4·49	+ 1·73	·46	25	25	68·5	14	46·0	1,30	0	0
,,		Tenbury (Orleton)	4·01	+ 1·89	·67	17	21	75·0	14	37·0	30	0	0
VII.		Leicester (Barkby)	3·27	+ ·83	·37	26	23	78·0	14	36·0	29	0	1
,,		Boston	2·77	+ ·65	·45	27	20	75·0	14	42·0	5	0	0
,,		Hesley Hall [Tickhill].....	3·29	+ 1·13	·56	13	20	72·0	2*c*	41·0	30	0	0
VIII.		Manchester(PlymouthGrove)	6·13	+ 3·04	·80	2	23	76·0	24	41·0	29	0	0
IX.		Wetherby (Ribston Hall) ...	3·20	+ ·86	·43	18	14	...	...	...	...	...	...
,,		Skipton (Arncliffe)	9·18	+ 4·85	1·23	23	26	70·0	4	36·0	30	0	...
,,		Hull (PearsonPark)	3·79	+ 1·15	·54	13	22	...	...	...	...	..	...
X.		Newcastle (Town Moor)	4·80	+ 2·09	·95	21	20	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	26·99	+18·54	6·14	24	28	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	8·23	+ 4·62	1·12	26	21	...	...	...	...	...	...
,,		Haverfordwest	6·11	+ 2·93	1·12	9	20	68·8	10	39·9	30	0	...
,,		Carno (Tybrith)	5·75	+ 1·98	1·01	25	24	65·0	19	36·0	22	0	...
,,		Llandudno.....	4·19	+ 1·83	·57	8	16	69·5	18	47·0	30	0	0
XII.	SCOTLAND.	Cargen [Dumfries]	8·41	+ 5·42	1·27	2	22	69·4	3	38·8	30	0	0
,,		Jedburgh (Sunnyside).....	4·93	+ 2·69	1·07	21	21	68·0	14*d*	39·0	30	0	...
XIV.		Old Cumnock	6·39	+ 2·97	·82	25	27	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	6·72	+ 2·16	·78	17*a*	23	...	...	37·0	29	0	...
,,		Oban (Craigvarren)	...	...	...	...	...	...	...	...	...	...	...
,,		Mull (Quinish).....	7·62	+ 3·47	1·51	31	23	...	...	...	...	...	...
XVI.		Loch Leven Sluices	6·20	+ 3·26	1·50	26	11	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	4·35	+ 1·78	·85	17	16	68·4	19*e*	40·3	29	0	0
XVII.		Braemar	5·18	+ 1·85	1·21	3	23	65·8	7	36·0	3	0	3
,,		Aberdeen (Cranford)	4·77	...	1·06	17	22	70·0	1, 8	37·0	29	0	0
XVIII		Strome Ferry.....	6·56	+ 1·89	1·00	25	25	...	...	...	...	...	...
,,		Inverness (Culloden)	2·60	+ ·60	·77	26	...	70·0	19	37·0	30	0	1
XIX.		Dunrobin	3·85	+ 1·45	·74	28	20	65·0	8	38·0	30	0	...
,,		S. Ronaldsay (Roeberry).....	4·51	+ 1·95	·69	18	23	62·0	2	40·0	29	0	0
XX.	IRELAND.	Dromore Castle	6·24	+ 1·26	·92	8	23	68·0	1	48·0	4, 21	0	...
,,		Waterford (Brook Lodge) ...	7·10	+ 3·68	·98	16	23	71·0	13	40·0	30	0	...
,,		O'Briensbridge (Ross)	9·01	...	1·43	24	26	74·0	2	47·0	*f*	0	0
XXI.		Carlow (Browne's Hill)	5·54	+ 2·57	·87	17	25	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	4·95	+ 2·43	·99	8	25	69·2	11	45·6	30	0	0
XXII.		Ballinasloe	6·82	+ 3·64	1·14	24	24	66·0	1	41·0	29*g*	0	...
,,		Clifden (Kylemore)	14·41	...	2·05	24	27	..	...	...	...	...	...
XXIII		Waringstown	6·04	+ 2·93	1·11	17	29	72·0	14	40·0	27	0	0
,,		Londonderry (Creggan Res.).	6·07	+ 1·95	·82	25	27	...	...	...	...	..	...
,,		Omagh (Edenfel)	7·45	+ 3·96	1·24	17	27	65·0	1	43·0	29	0	0

a And 31. *b* And 15, 16. *c* And 19, 20. *d* And 19. *e* And 27. *f* Various. *g* And 30.
+ Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON AUGUST, 1891.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail. S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The wettest August on record, at this station, for more than 30 years. Temperature very much below the average. Heavy storm and R on the 20th. T and L on 4th; T on 3rd and 21st.

ADDINGTON.—This August R has only once been exceeded, and that by only ·01 in., during 20 years, viz., in August, 1878. R falling so often, and in such quantities, prevented many from securing the hay crop, and did much damage to grain crops. Temp. low throughout, the night of the 30th being very cold. Brook flooded on the 28th. TSS on 3rd and 23rd.

BURY ST. EDMUNDS, WESTLEY.—TS on 10th, and T heard on 2nd, 3rd, and 4th. The corn stood the R well till the 27th, but wheat and barley were considerably damaged at the close, though, owing to high winds, not so much as might be expected.

LANGTON HERRING.—The wettest month since November, 1888, and the coldest and wettest August in 20 years. The temp. never once rose above 69°, 72° being the previous lowest max. The mean temp. at 9 a.m., 59°·5, is 2°·7 below the average. The grain crops are considerably injured. T on 3rd, 4th, 5th, and 23rd.

BODMIN.—Very unseasonable, with excessive R and some very heavy falls, especially on the 17th (1·04 in.), the 20th (1·54 in.), and the 27th (·86 in.). Very hindering for harvest operations. The wettest August for more than 20 years. Rather cold and stormy, especially on 25th and 26th. August, 1852, was very similar.

STROUD.—Heavy showers, with T and L on the 10th, when ·32 in. of R fell in 10 minutes at 2 p.m., T on 4th, 21st, and 23rd. Gale from the S.W. on 25th.

WOOLSTASTON.—Cold, wet, and stormy, with scarcely any sunshine; a disastrous harvest month. Only six days without R. A severe gale on the 25th. Scarcely any grain cut at the end of the month, and hay harvest not finished. Mean temp. 56°·5. TSS on the 4th and 21st.

ORLETON.—A cold, wet month; in fact the wettest month of August since 1879. The max. temp. was above 70° on only 5 days, and the max. for the month (75° on 14th) was the lowest August max. recorded here since 1867. Mean temp. about 1° below average. Great gale on night of 25th, doing much damage to hops and fruit. T and L on 4th and 21st.

LEICESTER, BARKBY.—Mean temp. of the month, 59°·7. T on 5 days. From June 23rd to August 31st inclusive there have been 47 days on which R fell out of 70, or two days out of three. Very trying for haymakers, and now for those getting their harvest. High wind from 24th to 27th.

HULL, PEARSON PARK.—TSS with H and R on 28th and 29th.

NEWCASTLE-ON-TYNE.—In July and August 9·55 in. of R fell, or more than the aggregate of the previous six months (8·88 in.)

SEATHWAITE.—On the 24th and 25th 10·24 in. of R fell; on the 30th and 31st 5·14 in. fell, and on the 8th and 17th also the falls exceeded an inch.

WALES.

HAVERFORDWEST.—The month was characterised by excess of R, and the temp. was low for August, never once reaching 70°. Strong winds prevailed, especially on the nights of the 25th, 26th, and 31st, when it blew a full gale. The corn crops have been beaten down in many districts, but no real damage has been done, and there is every prospect of a good harvest if fine weather should set in. The quality of the grain, especially barley and oats, is excellent. During the last week there was a good deal of L at night. Westerly and south-westerly winds prevailed.

SCOTLAND.

CARGEN.—The wettest and most inclement August ever recorded at this station. During the period of 31 years there have been only nine months when this amount of R has been exceeded. Strong gales occurred on the nights of the 25th and 31st. Mean temp. of the month 1°·6 below the average. Sunshine 66 hours less than the average. T on 2nd, 21st, and 29th. The damage done to the cut and growing corn has been most serious, and the potato disease is showing itself extensively in this district.

JEDBURGH.—The month has been unsettled, with much R and wind and a very sunless sky. Hay in pasture district much injured ; corn cutting hardly commenced at the close, and will not be general for a fortnight, even with much sunshine ; T and L on the 3rd, 18th, 19th and 20th.

CULLODEN.—The weather was cold, with a very small amount of sunshine, and at times heavy R. Crops late ; harvest not commenced.

S. RONALDSAY, ROEBERRY.—A very wet month ; R much above the average.

IRELAND.

WATERFORD, BROOK LODGE.—The wettest August for over 32 years ; the wettest month since February, 1884. Mean temp. 57°·2. T on 3rd, T and L on 21st ; ·15 in. of R fell in 12 minutes on the 5th, and on the 25th ·77 in. between 9 a.m. and 6 p.m. ; gales from S.W. on 25th and 31st.

O'BRIENSBRIDGE, ROSS.—The R of the month has beaten the August record of 43 years. In 1848 there fell 9·80 in., but on fewer days, and the effect was less disastrous to crops. T and L was of frequent occurrence.

DUBLIN.—An exceedingly unsettled, cool, rainy and even stormy month ; it being the third consecutive year in which August has been unfavourable. High winds on 13 days attaining the force of a gale on three occasions 12th, 26th, and 31st ; TS on the 9th, T on the 3rd and 21st, L on 28th, H on the 3rd. A solar halo was seen on the 30th, and lunar rainbows appeared on the night of the 25th.

BALLINASLOE.—Heavy R and strong gales occurred after the 8th ; corn much damaged ; potato blight appeared about the middle of the month.

CLIFDEN, KYLEMORE.—On six days the fall exceeded 1·00 in., while in 48 hours on 24th and 25th 3·07 in. fell, and in the same time on 30th and 31st, 3·32 in. fell.

WARINGSTOWN.—Unusually wet, especially the last fortnight ; a good deal of meadow hay was lost in consequence, and considerable damage was done to other crops ; oats laid, and potatoes in most cases showing disease. A fine September would do much to repair the damage done as yet.

EDENFEL.—The R of August (7·45 in.) of which 5·30 in. fell during the last 15 days, is by far the heaviest fall recorded here during 27 years in any summer month, and has only only once been exceeded in any month, viz. : by 7·67 in. in December, 1876. The average R of the first six months was nearly one-third short of the average, but this has been exactly recouped by the fall of the last two months ; this, coupled with the fact that an August rainfall above the average is almost always followed by a September fall below the average, is the one ground of hope left us. Late hay is irretrievably damaged. Potatoes though gone in the haulm are sound at the root, and oats—our staple crop—encased in its hardy husk, cares little for rain if fine weather only follows.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCCIX.] OCTOBER, 1891. [PRICE FOURPENCE, or 5s. per ann. post free.

William Ferrel.

1817—1891.

IN PROFESSOR FERREL it is not merely the meteorologists of the United States who have sustained the loss of one of their deepest thinkers, the science generally is weakened by his loss. We were going to say that Ferrel was a self-made man, but that is scarcely the term to apply to a man whose innate genius being recognised by his countrymen, was by them almost compelled to accept appointments which he did not seek. The extremely mathematical point from which he viewed every subject, rendered many of his works quite beyond the comprehension of ordinary readers, and even when, as in his "Popular Treatise on the Winds," and his "Popular Essays on the Movements of the Atmosphere," he tried to write down to a lower level, it was evidently difficult for him to do so. Ferrel's work was in the fundamentals of meteorology; and just as the finest bridge will fail if the foundations are not well laid, and yet the ordinary public look only on the superstructure, so the name of Ferrel is by no means as well known as that of many who have built upon his foundations. We are not sure that anyone knows even yet how much is due to the man who, born as a farmer's boy, died a Member of the National Academy of Sciences, one of the 16 Honorary Fellows of the Royal Meteorological Society, one of the 15 Ehrenmitglieder of the Oesterreichischen Ges. für Meteorologie, and one of the 18 Ehrenmitglieder of the Deutschen Meteor. Gesellschaft.

UNDERGROUND TEMPERATURE.

Die Bodentemperaturen an der K. Sternwarte bei München und der zusammenhang ihrer schwankungen mit den Witterungsverhältnissen. Von DR. KARL SINGER. Ackerman, München, 1890. 4to, 24 pages, 1 plate.

AN interesting and well-worked-up summary of the results of the earth thermometers at Munich during the 29 years, 1861 to 1889.

The principal results are :—

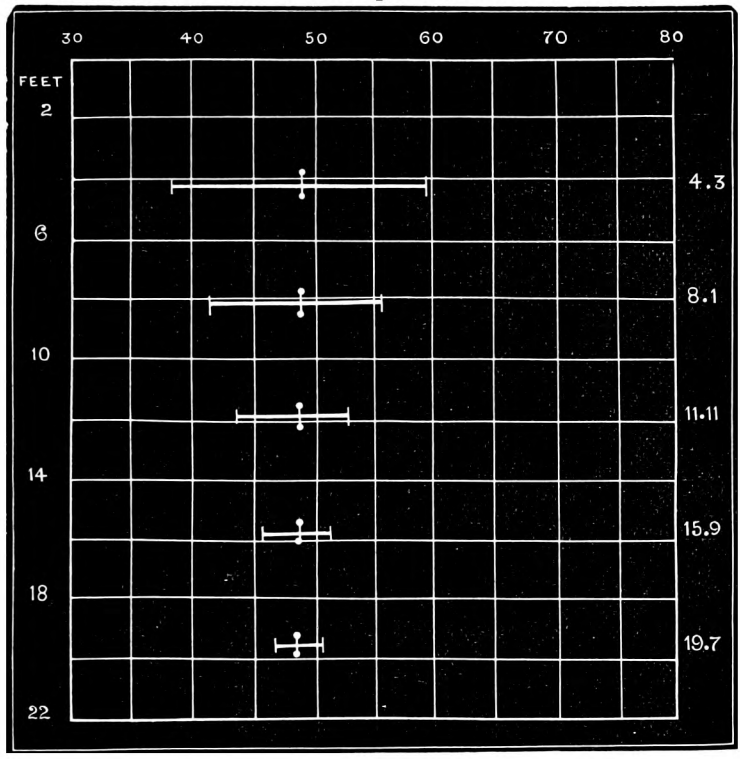
Depth.	Temperature.				Average Dates.	
	Mean.	Min.	Max.	Range.	Minimum.	Maximum.
ft. in.	°	°	°	°		
4 3	48·5	38·2	59·3	21·1	March 2	August 24
8 1	48·5	41·6	55·6	14·0	,, 27	September 12
11 11	48·4	43·7	53·1	9·4	April 13	October 7
15 9	48·4	45·3	51·6	6·3	May 3	,, 25
19 7	48·3	46·2	50·3	4·1	,, 23	November 17

These values will be better understood if shown on a diagram—and (as indicating how generally accordant are observations of this class) we give the diagram exactly on the same scale as one representing the Greenwich earth temperature in 1874, in the *Quar. Jour. Met. Soc.*, Vol. III., p. 422. We have, however, added another with two lines, which may perhaps be original—it is rarely safe to say that anything is so. The lines join the dates of minimum and of maximum at the respective depths, and they show how harmoniously the diminution in the range of temperature, and the retardation in the date of occurrence of the extremes, proceed. In fact, subject to future correction, we think that it may be accepted as approximately true, that for each foot of depth the minimum and the maximum are each retarded 5 days. Take for instance these Munich values, and for convenience take them as even depths of 4 ft. (they are really 3 ft. 10 in.) each, then we have 20 days retardation for each 4 feet (16½ days for each metre).

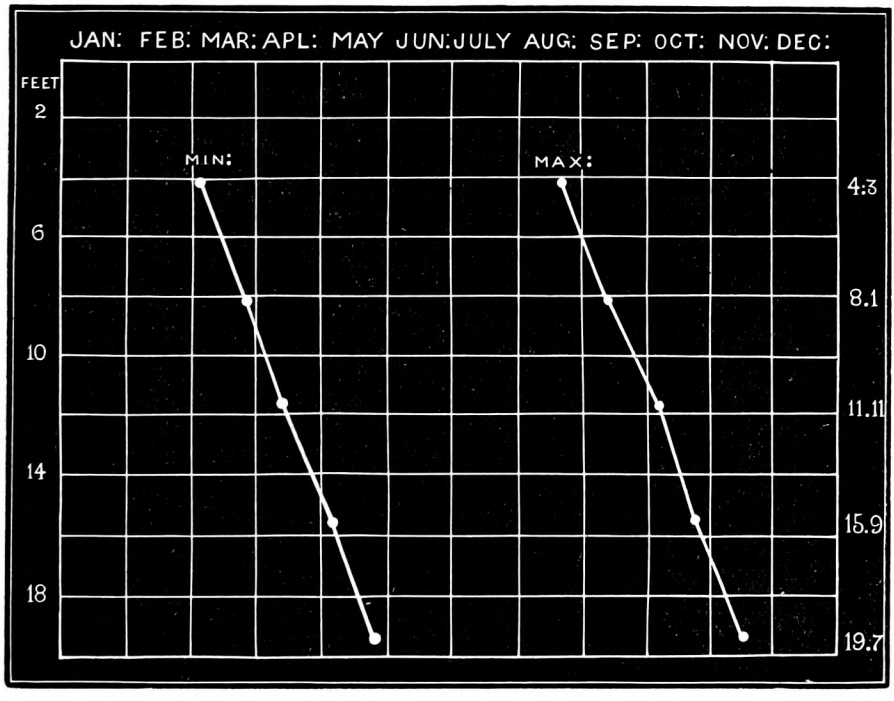
	Minimum.			Maximum.		
Depth.	Observed.	Computed.	Error.	Observed.	Computed	Error.
4 ft.	March 2	—	—	Aug. 24	—	—
8 ft.	,, 27	March 22	— 5	Sept. 12	Sept. 13	+ 1
12 ft.	April 13	April 11	— 2	Oct. 7	Oct. 3	— 4
16 ft.	May 3	May 1	— 2	,, 25	,, 23	— 2
20 ft.	May 23	May 21	— 2	Nov. 17	Nov. 12	— 5

From this we further see that the minimum and the maximum will be each six months late—*i.e.* the minimum will occur shortly after midsummer, and the maximum shortly after midwinter, at a depth of about 37 ft., and the deepest observations yet regularly taken accord very fairly with that theory.

Min., Mean and Max. Temperatures at various depths.



Retardation of Date of Min. and of Max. Temperatures with increasing depth.



Just for the sake of curiosity we have taken Prof. Everett's excellent discussion of the Greenwich earth temperatures, and applied the same rule to them. The following are the results :—

	Minimum.			Maximum.		
Depth.	Observed.	Computed.	Error.	Observed.	Computed.	Error.
1 in. ...	Jan. 24	... —	... —	July 26 ...	—	... —
3 ft. ...	Feb. 8	... Feb. 8	... 0	Aug. 9 ...	Aug. 10	... + 1
6 ft. ...	,, 24	... ,, 23	... — 1	,, 25 ...	,, 25	... 0
13 ft. ...	Mar. 27	... Mar. 30	... + 3	Sept. 25 ...	Sept. 19	... — 6
26 ft. ...	June 1	... June 3	.. + 2	Nov. 30 ...	Nov. 23	... — 7

Therefore both at Munich and at Greenwich 5 days retardation for each foot of depth is right within 2 per cent.

It will be noticed that the mean temperature decreases as greater depths are reached about 0°·2 for 20 ft. ; we do not understand this. A still greater decrease is shown by the Greenwich observations, but thousands of observations all the world over prove that the temperature of the earth increases as we penetrate its crust. We have devoted some time to tabulating and plotting three long series of observations—Adelaide 21 years, Sydney 17 years and Melbourne 15 years—and the result is to confirm our dislike of the old pattern of earth thermometer, and to induce us to believe that the sooner new pattern thermometers, the index errors of which can be verified from time to time, are put down by the side of the present ones, the better. It would seem preposterous to give the index errors of thermometers buried in the soil on the other side of the globe; we therefore merely ask our Australian friends to put down fresh thermometers, and so test their old ones. We have no doubt whatever that if the Greeenwich authorities did so, the decrease they now state to exist would be reduced, if not converted into an increase. Surely no one will now defend the use of thermometers the accuracy of which cannot be verified.

REVIEW.

Meteorologische Volksbücher. Ein beitrag zur Geschichte der Meteorologie und zur Kulturgeschichte. Von Prof. Dr. G. Hellmann. H. Paetel, Berlin, 1891, large 8vo, 53 pages.

Dr. Hellmann is probably the highest living authority on Meteorological literature, and in this little work we have not merely accounts of some of the very earliest printed books upon meteorology, but also critical and explanatory notes by a master hand.

We, of course, cannot translate all these 53 large pages and transfer them to our own, for it would fill several numbers, and yet we believe that they would be of considerable and wide-spread interest.

Dr. Hellmann goes back to—indeed, in many cases beyond—the invention of printing, and shows how the popular treatises upon meteorology current in Germany four hundred years ago, were based upon still earlier manuscripts. He devotes naturally much attention to the "Book of Nature," the oldest treatise on Natural History written

in German. It was written by Konrad of Megenburg, about 1350, and first printed at Augsburg in 1475, with 12 woodcuts—being itself based on a still earlier MS. by Thomas Cantimpratensis, a Belgian.

In Konrad's book the second section deals with meteorology, under the general heading of "Concerning the heavens and the seven planets." The first nine chapters deal with astronomy, the subsequent ones are :—

10. Of the Air.
11. ,, Moving Stars (comets, milky way, shooting stars).
15. ,, the Winds.
16. ,, the Rain.
17. ,, the Dew.
18. ,, the Snow.
19. ,, Hoarfrosts.
20. ,, Hail.
22. ,, Mildew.
22. Of Honey.
23. ,, Ladanum Wood.
24. ,, Manna.
25. ,, Thunder and Lightning.
26. ,, Fog.
27. ,, Solar Halos.
28. ,, Double Suns.
29. ,, Sun Streaks.
30. ,, the Rainbow.

Perhaps the best idea of the work will be given by taking a single paragraph and giving it, first in the quaint old German and then in a free translation. Here is one from the chapter on Wind :—

"Ez geschiht oft, daz die widerwärtigen wind begegent ainander, als der sudner dem nordner oder der ostner dem westner. Welher denne sterker ist, der wirft den andern zuo der erden oder in ain wazzer also vesticleich ze stunden, daz er scheff under kert. Ist aber, daz si gleich starch sint, so ringent si mit ainander so vast, daz si paid zuo der erden vallent und varnt in ainer snellen werbeln weise und zuckent oft mit ainen grozen stain oder ainen menschen oder ain ander swaerez dinch und füerent daz mit in auf in die lüft. Wenne aber si also vallent in daz mer, so werfent si daz mer-wazzer auf und giezent ez an daz lant und verderbent läut und guot."

"It often occurs that winds resist one against the other ; as for instance, the S. against the N. or the E. against the W. ; whichever is the stronger will drive the other to the earth or into the water, so as to blow the ships over. If they are equally strong, they struggle so much, that they fall to the earth together, and in a rapid whirl they will often suck up large stones or a man or any other heavy thing, and carry it up with them into the sky ; If, however, they fall in the sea, they suck up the sea water and carry it on to the land."

We cannot refer at length to Dr. Hellmann's notes upon Elucidarius, and the little weather prognostic books, down to Raspail and Mathieu (De la Drôme), but as a specimen of the completeness of his work (even when he professes to give only a selection), he quotes as among the authors of modern English books of weather prophecies, Blake, Doxat, Leigh, Murphy, Simmonite and Whistlecraft. Few Englishmen could have given a fuller list.

The book is like most of Dr. Hellmann's, crammed with information, so that it is almost impossible to lay it down, and he constantly startles one with bits of information where least expected ; for instance, when speaking of Conrad's "Book of Nature" as the popular text book of the 15th century, he refers to the "Sphaera Mundi" of Sacro Bosco, and then in a foot note he goes off to tell us

that Joannes de Sacro Bosco was a learned Englishman, born at Holywood (=Sacro Bosco), in Yorkshire, who early in the 13th century was teaching at the University of Paris, where he wrote "Sphaera Mundi," which was subsequently much recommended by Melancthon. We did not know of any Holywood in Yorkshire, but on reference to Poggendorff's invaluable *Biog.-Lit. Handwörterbuch* we see that he is described as "Joannes de Sacro Bosco (Sacrobusto, Sacrobuschus = Holy wood, Holy bush) born at Holywood, now Halifax, in Yorkshire;" the date of birth is not given, but was probably between 1180 and 1200. Although we find that Sherburn in his scarce translation of Manilius also states Halifax to have been the birth-place, we are doubtful—authorities differ, and we can find no one else who describes Halifax as ever having been called Holywood. There are three suggested derivations of the name of Halifax: (1) Halig fax—Holy Hair (because at the shrine they had the hair of the Virgin Mary); (2) Holy face (because at the shrine they had the face of John the Baptist); (3) Holy ways (*Fax* in Norman-French) because of the shrine at the intersection of four roads. Domesday Book does not mention Halifax, but it was written about 100 years before Joannes de Sacro Bosco was born.

The book is as well printed as are all those issued by the Urania Society, and additional interest is given by the facsimile reproduction of the title-pages of some of the rarest pamphlets.

RAIN MAKING.

THIS subject is one upon which it is extremely difficult to pronounce a decided opinion, and upon which even persons who witness the experiments cannot be certain as to their success.

We have always been ready to welcome any help as to weather prophecy, and we are ready to do the same for rain makers—when they have proved their case.

In this country it is not often that we need try to increase the fall of rain. But any real control over atmospheric phenomena seems so improbable that experiments in that direction have not merely to justify themselves by the result, but have also to remove strong prejudices from many minds.

We stated in our July number [p. 81] that General Dyrenfurth was trying the effect of firing powerful explosives both on the ground, and at considerable heights, in Kansas, one of the dry States in the centre of North America.

The difficulty in deciding upon his success, lies *not* in ascertaining whether rain follows within a reasonable period after the discharge of his explosives, but in knowing whether or not rain would have fallen had the explosives not been discharged. As regards his experiments we think that General Dyrenfurth designed them well, and tried them in a locality in which the difficulties to be overcome were greater than usual. Perhaps we had better amplify that remark so that everyone may understand it. Rain falls because the air whence it falls is *at its then temperature* unable to hold any more

vapour, the surplus vapour falls as rain. Raise the temperature of that air, it can then hold more vapour and rain will cease to fall. Cool the air, it can hold less vapour and the rain will become heavier.

General Dyrenfurth's theory was, we presume, that his violent explosions would cause unusual vertical motion in the air, and thus some of the warm air from the lower strata would be forced up into colder regions, and the vapour in it would be condensed and fall as rain. Evidently the drier the district the greater must be the disturbance in order to produce condensation. Kansas is a very dry State, and that is why we said that the difficulties were greater than usual.

We have at present no official information as to the experiments, but on August 27th the New York correspondent sent the following telegram to the *Standard*, in which paper it appeared on the 28th :—

NEW YORK, THURSDAY NIGHT.

Within the last three weeks nine showers of rain, of which one was considerable, have been artificially produced in a region almost rainless normally. The district selected for experiment by the United States Agricultural Department is near the midland staked plains of Texas, a grazing country, where agriculture is impossible because of the aridity of the climate. For more than three years no rain has fallen there, except in very occasional small showers.

On Wednesday the vegetation was parched, the sky unclouded, the barometer at 30·50, the hygrometer between dry and very dry. The cow boys, who are shrewd judges of the weather, declared that rain was impossible. With this condition of the atmosphere, the following experiment was tried :—

Five balloons, each twelve feet in diameter, and charged with one-third oxygen and two-thirds hydrogen, were exploded by electricity or time fuses, at heights ranging from one thousand feet to five miles. Three hundred and fifty pounds of Rackarock dynamite was also exploded in scattered packages, of from ten to twenty pounds, at intervals of one minute, ending at ten o'clock p.m. At three o'clock the next morning a sharp clap of thunder was followed by heavy rain. At sunrise a beautiful rainbow was seen. The rain stopped at eight o'clock, but began again to fall after more explosives had been used.

Evidently the writer regarded the experiments as having been successful ; we, however, wait for full details—for something better than a hygrometer which stood " between dry and very dry."

Of course anything of the above kind is sure to have imitators ; there are already two in the field.

1. A Mr. Melbourne, of whom we had not previously heard, though he is said to have broken up 12 droughts in Australia, and 5 in New Zealand, is reported to have established a laboratory at Canton, Ohio, and by the action of some wonderful machine in this laboratory to produce rain at will. If this is not entirely a fictitious story, it sounds like one.*

* Evidently Mr. Melbourne is looking out for money. The following telegram appeared in *The Times* of October 13th, 1891 :—

A CONTRACT TO MAKE RAIN.—*Topeka* (*Kansas*), *Oct.* 12th.—Melbourne, the rain-maker, signed a contract on Saturday with a local organization to water the north-western part of Kansas during June, July, and August, 1892, at a rate of $1 per acre of the area watered. It is his intention to hold a series of mass meetings throughout the North-Western States for the purpose of awakening interest in his enterprise.—*Dalziel.*

2. This is more definite; we have abridged it from an article in the *Chicago Journal of Commerce* for July 23rd, 1891. Mr. Louis Gathman, of Chicago, begins by accepting the theory of rain being produceable by the discharge of artillery, but says that such cannonading must be very costly, and that the object of explosions, that is to say, the creation of vertical currents, can be more cheaply obtained by exploding at a great altitude shells filled with liquified carbonic acid, the rapid expansion of the gas creating an extensive current of cold air. Mr. Gathman seems to have tried only one experiment at a considerable height, viz., in 1890, when he fired such a shell from Fort Sheridan; but the result was not in accordance with the theory. The shell was thrown to an altitude "of about 600 ft. and then exploded, producing a cloud or visible vapour (in the clear sky), which drifted along with the current of air, and was visible for several miles." We think all the better of Mr. Gathman for this statement, a quack would never have admitted that it "drifted along" instead of pouring down, as by theory it ought to have done. He then says that even with small quantities of the compressed gas, and the small elevation of his astronomical observatory (75 ft.) he has produced showers on a small scale. We think that a very large manufactory will be needed to produce cooling mixture enough for even one State of the Union.

Lastly, we re-print from an American paper a rather amusing article, the conclusion of which is diametrically opposed to the report in the *Standard*, and which therefore supports our decision to wait for something more authorative than the hygrometer which "stood between dry and very dry."

EXPERIMENTS IN RAIN-MAKING.

"When the official rainmaker of a black tribe in equatorial Africa is paid, a proper number of goats and fowls to bring down a little moisture for the benefit of the crops of his less-gifted tribesmen, he collects with due solemnity his magic herbs and other charms, greases himself with palm oil, grasps his sacred rattle and begins to tamper with the weather. Unfortunately the matter of artificial rainfall in Africa has not been studied by Caucasian scientists with that care which the learning of their gifted black brothers who practice the art at reasonable rates would seem to merit. In consequence of this the precise method of bringing on a precipitation of moisture varying from a light dew to a tremendous downpour is not known beyond the borders of those great forests where dwell the pigmies, the anthropophagi, and other wild people done in black.

"The United States Government, however, has decided to go into the rain-making business on its own account. Singularly enough, no soulless corporation of grasping capitalists has yet provided the arid regions of the West with summer showers, spring rains and miscellaneous drizzles to suit the taste. Senator Farwell of Chicago, desiring to supply this want, secured from the last Congress, which had a billion to spend and spent it royally, a modest appropriation to be used in producing experimental showers. Not since Prof. Morse obtained money from Congress with which to build a telegraph line from Washington to Baltimore has the Nation indulged in such a fantastic enterprise. The scoffers of that day knew very well that it was wretched nonsense to think that people could talk with each other over a wire by means of a clicking instrument, and they said so very plainly. Though these scoffers were wrong

and Prof. Morse was right, this does not prove that the rain-making experiments which the Government now has under way are bound to be a success.

"Some persons may be surprised to learn that the approved Darkest-Africa method of producing thunder-storms is not to be employed by the rainmakers of the United States. They are not content to shake a rattle made of a calabash with pebbles in it, to dance wildly in a circle and to howl forth tremendous incantations. Such proceedings as these may yield copious showers in the Congo Free State and in the vicinity of Ujiji, but they are not suited to the climate of the American rainless zone. A new method, which doubtless would appear sufficiently ludicrous to the experienced meteorologists of Ngoombe and Bolobo, has been approved by the chiefs of the Signal Service Bureau and the Smithsonian Institution. By this method a formidable quantity of a high explosive is sent up in a balloon and then touched off with an electric spark when it has reached the proper altitude.

"The other day Gen. Robert G. Dyrenforth, who now holds the responsible position of head rainmaker for the Government, went out to Piney Creek, not far from Washington, with three balloons and a supply of oxyhydrogen. Along with him went Assistant Secretaries Nettleton and Spaulding of the Treasury Department, Comptroller Lacey, Assistant Secretary Willetts of the Agricultural Department, Director Howell of the Geological Survey and Patent Commissioner Mitchell. These gentlemen were fully equipped for the work of producing a rain-storm. With singular recklessness, which cannot be too severely condemned in persons holding high official positions, they uttered no warning to the people of Piney Creek so that those people might get out their umbrellas. They merely started in coldly and imperturbably to make it rain.

"Gen. Dyrenforth sent up one of his muslin balloons inflated with 525 cubic feet of oxyhydrogen, and this was exploded at a height of 800 feet. No rain-cloud gathered; no heavy drops pattered down indicating that a shower was impending. The General grieved, but not disheartened, sent up his two remaining balloons, touched them off at a height of 1,000 feet, and then spread his umbrella and waited. The detonations shook down no drop of moisture. The ammunition was all gone and the denizens of Piney Creek had escaped a wetting. The distinguished gentlemen were somewhat disappointed, though their experiments had passed off admirably, with the slight exception that they had failed to make it rain. However, they were consoled by the knowledge that the professional rainmakers of the African forest do not always bring on a shower when they dance sagely in magical wise and utter their most persuasive yells.

Two thousand dollars has been spent thus far without producing so much, as a heavy dew. There is $7,000 yet to be used for the same purpose and Gen. Dyrenforth thinks he may succeed with its aid in creating a cloud-burst on a cactus plain where rain has not fallen for a thousand years."

THE CLIMATE OF THE BRITISH EMPIRE DURING 1890.

The number of stations available for our annual summary of the climates of the Empire is above the average, and with the exception of Esquimalt, British Columbia, which in the middle of the year replaced Victoria, British Columbia, where the observations had been discontinued, all appear that are printed in the monthly tables.

The table for 1890 exhibits some exceptional features: for the first time in the 17 years during which the tables have been published the highest temperature occurred at an East Indian station, instead of in Australia, and the following table shows clearly how phenomenal this is, for the 1890 max. at Calcutta is with one exception the highest in 9 years, while the Adelaide max. is 2°·4 lower

than that of any other year in the same period. The highest max. in sun was, however, recorded at Adelaide, though it is not exceptional for this to occur at Calcutta.

We add, for comparison, the highest shade temperatures at three of the stations at which the max. of the year usually exceeds 100°.

Absolute Maximum Temperature.

	Calcutta.	Melbourne.	Adelaide.
	°	°	°
1882	101·5	110·5	112·0
1883	100·2	104·9	109·5
1884	103·7	100·7	110·2
1885	105·3	101·6	107·4
1886	103·5	104·1	112·4
1887	102·0	104·9	111·2
1888	106·6	104·0	107·5
1889	101·8	99·8	109·0
Mean	103·1	103·8	109·9
1890	105·6	103·4	105·0

The mean temp. of the East Indian stations, on the other hand, far exceeds that of Australia, and Ceylon, year after year, heads the list with a mean above 80°; nearly 20° higher than that of Adelaide.

Winnipeg, of course, monopolises all the other extremes of temperature, for the cold even at the other Canadian stations bears no comparison with the extreme rigour of its winters.

It is also unusual for the least range in the year and the least mean daily range to occur at different stations, although this has occurred more than once before. Small range of temp., great humidity, and a large amount of cloud, of course, all occur at insular stations, and London, Ceylon, Barbados, and Mauritius, have at one time or another recorded the extremes of most of these elements.

SUMMARY.

Highest Temp. in shade	105°·6 at Calcutta on April 24th
Lowest „ „	— 39°·4 at Winnipeg on January 17th
Greatest Range in year	135°·9 at Winnipeg
Least „ „	25°·4 at Ceylon, Colombo
Greatest Mean Daily Range ...	22°·9 at Winnipeg
Least „ „ „ ...	10°·1 at Mauritius
Highest Mean Temp.	80°·5 at Ceylon, Colombo
Lowest „ „	32°·8 at Winnipeg
Driest Station	Adelaide, mean humidity 62
Dampest Station	London, mean humidity 80
Highest Temperature in Sun ...	163°·9 at Adelaide
Lowest Temperature on Grass	— 7°·1 Toronto*
Greatest Rainfall	82·90 in. at Trinidad
Least „	19·96 in. at Jamaica
Most Cloudy Station	Tasmania, Hobart, average amount 6·5
Least Cloudy Station	Malta, average amount 3·4

* There being no grass min. thermometer at the other Canadian stations.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1890.

STATIONS. *Those in Italics are South of the Equator.*	ABSOLUTE. Maximum. Temp.	Date.	Minimum. Temp.	Date.	AVERAGE. Max.	Min.	Mean.	Dew Point.	Humidity.	ABSOLUTE. Max. in Sun.	Min. on Grass.	TOTAL RAIN. Depth.	Days.	AVERAGE. Cloud.
	°		°		°	°	°	°		°	°	in.		0—10
England, London ...	79·7	August 5	14·9	December 22	56·9	42·1	49·5	42·5	80	126·9	5·5	21·23	161	6·3
Malta	97·5	August 25	40·2	March 3	71·5	58·4	65·0	55·3	76	149·4	34·0	21·41	84	3 4
Cape of Good Hope.	97·2	December 3	31·6	July 18	69·5	53·4	61·5	...	...	...	...	26·34	...	4·6
Mauritius	84·4	January 15	53·5	July 26	77·8	67·7	72·7	64·4	78	139·5	45·6	53·17	208	6·0
Calcutta	105·6	April 24	47·5	December 29	86·3	70·2	78·2	70·4	78	161·4	37·9	61·28	124	4·5
Bombay	92·8	April 12	65·2	December 14	85·5	74·7	80·1	71·4	75	149·0	49·1	65·18	116	4·2
Ceylon, Colombo ...	91·4	January 10	66·0	January 25	86 1	75·0	80·5	71·9	77	152·0	58·0	72·83	206	6 0
Melbourne	103·4	February 6	29·0	July 16	67·7	50·4	59·1	49·2	72	156·5	23·6	24·24	140	6·2
Adelaide.....	105·0	January 18	34·2	July 17	70·3	53·2	61·7	49·2	62	163·9	25·0	25·77	139	4·8
Tasmania, Hobart..	97·8	January 9	31·8	July 18	62·6	48·0	55·3	49·1	79	146·0	26·5	27·51	173	6·5
Wellington	82·0	February 10	32·0	August 15	62·7	48·9	55·8	...	...	139·0	27·0	45·23	165	4 1
Auckland	82·0	February 11	40·0	May 13, Aug 15	66·5	53·6	60·0	50·5	72	147·0	29·0	...	...	5·8
Jamaica, Kingston..	94·4	July 21	60·2	February 4	87·9	69·8	78·8	68·5	72	...	...	19·96	...	..
Trinidad.....	96·0	September 10	60·0	August 26	86·1	69·2	77·6	70·1	79	160·0	...	82·90	213	...
Toronto	89·4	August 3	— 2·7	March 6	53·1	37·0	45·1	39·0	78	...	—7·1	37·38	206	6·2
New Brunswick, Fredericton. ...	88·2	August 4	—24·0	January 10	49·0	29·0	39·0	33·8	73	...	...	48·99	175	5·8
Manitoba Winnipeg	96·5	June 26	—39·4	January 17	44·2	21·3	32·8	...	...	...	...	23·67	144	4·8

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MARCH, 1891.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute.				Average.				Absolute.		TotalRain.		Aver.
	Maximum.		Minimum.										
	Temp.	Date.	Temp.	Date.	Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	57·7	2	23·7	12	47·8	34·6	34·7	80	101·1	18·0	2·01	15	6·5
Malta	71·1	11	39·8	4	62·4	49·0	46·6	77	135·3	33·0	·17	4	4·6
Cape of Good Hope	91·7	20	46·8	7	79·5	57·9	...	...	...	...	·38	5	...
Mauritius	83·6	3, 9	65·2	25	81·4	71·8	69·1	80	134·8	57·3	11·74	18	6·7
Calcutta	91·5	22	62·9	12	84·9	67·8	67·4	76	154·8	57·8	3·94	9	4·7
Bombay	87·0	4, 18	69·0	14*b*	84·6	72·0	66·5	67	137·1	56·6	·20	1	1·2
Ceylon, Colombo	91·0	23	69·8	2	87·8	73·9	71·8	77	147·0	65·0	9·43	15	4·2
Melbourne	99·5	7	45·8	1	75·7	55·7	53·2	66	148·2	33·4	1·26	6	5·1
Adelaide	102·6	7	50·0	23	81·9	57·9	49·6	48	157·4	39·7	·57	4	1·8
Tasmania, Hobart	97·5	7	45·0	2, 24	73·3	52·5	51·0	62	142·0	37·8	·96	7	5·5
Wellington	81·0	11	43·0	22	67·7	52·5	55·2	84	130·0	35·0	1·45	10	4·1
Auckland	77·0	8	46·0	22	71·2	57·7	56·7	81	138·0	42·0	1·57	22	5·2
Jamaica, Kingston	91·4	15	63·2	3	85·8	67·4	65·4	70	...	...	·04	...	...
Trinidad	94·0	26	64·0	11*c*	87·9	68·6	66·4	69	156·0	52·0	·03	3	...
Toronto	52·1	29	4·7	6	35·0	22·5	23·5	77	...	−3·2	3·03	20	6·7
New Brunswick, Fredericton	48·8	14*a*	11·6	15	36·2	16·4	21·2	70	...	...	3·66	16	4·8
Manitoba, Winnipeg	50·5	28	−28·1	4	22·0	−3·9	...	92	...	...	·15	6	4·1
British Columbia, Esquimalt	57·6	14	20·0	3	47·5	35·0	36·9	83	...	...	3·42	21	6·2

a And 29. *b* And 15. *c* And 23.

REMARKS.

MALTA.—Mean temp. 54°·4 ; mean hourly velocity of wind 9·0 miles. Sea temp. rose from 57°·9 to 61°·1. A little H fell on the 3rd. J. SCOLES.

Mauritius.—Mean temp. of air 1°·4 below, dew point 0°·7 below, and R 3·53 in. above, their respective averages. Mean hourly velocity of wind 9·3 miles, or 0·7 below the average ; extremes, 30·9 on 19th and 0·0 on 5th, 6th and 29th ; prevailing direction S.E. by E. L on 2nd and 4th, and T on 5th, 6th, and 29th. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on 9 days, and L was seen on 7 other days. J. C. H. CLARKE, Lieut.-Col., R.E.

Melbourne.—Mean temp. of air 2°·0 above, of dew point 1°·2 above, humidity 2 below, cloud 0·5 below, and R ·80 in. below, their respective averages. Prevailing direction of wind S. ; strong on 5 days. Heavy dew on 5 days. T and L on the 9th, L on the 10th and 16th. T on 25th and 30th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 0°·5, and R ·50 in. below, their averages of 34 years. Amount of cloud lower than in any previous March ; 17 clear days. C. TODD, F.R.S.

Hobart.—Mean temp. 4°·3, and humidity 12 above, the average of 7 years. J. SHORTT, Capt. R.N.

Wellington.—Generally fine up to the 14th, with strong N.W. wind in the early part ; from the 14th to the end showery, with intervals of fine weather. Prevailing wind N.W., strong on 5 days. L on 1st. Fog on 16th and 17th. Mean temp. 2°·0 below, and R less than half, the average. R. B. GORE.

Auckland.—A rather dry month, with no heavy falls of R, or strong winds. Mean temp. and R both considerably below the average. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL, SEPTEMBER, 1891.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in			in.
II.	Dorking, Abinger Hall.	1·49	XI.	Builth, Llanwrtyd Wells	4·33
,,	Margate, Birchington...	...	,,	Rhayader, Nantgwillt..	4·18
,,	Brighton, Prestonville Rd	1·14	,,	Corwen, Rhug	4·07
,,	Hailsham	·93	,,	Carnarvon, Cocksidia ...	6·50
,,	Ryde, Thornbrough	1·21	,,	I. of Man, Douglas	6·91
,,	Alton, Ashdell.....	1·63	XII.	Stoneykirk, Ardwell Ho.	2·70
III.	Oxford, Magdalen Col...	1·34	,,	New Galloway, Glenlee	6·76
,,	Banbury, Bloxham	1·19	,,	Melrose, Abbey Gate...	4·55
,,	Northampton	·50	XIII.	N. Esk Res. [Penicuick]	10·35
,,	Cambridge, Fulbourne..	1·44	XIV.	Ballantrae, Glendrishaig	4·79
,,	Wisbech, Bank House..	·72	,,	Glasgow, Queen's Park.	4·78
IV.	Southend	·48	XV.	Islay, Gruinart School..	4·05
,,	Harlow, Sheering	·96	XVI.	Dollar.....	6·41
,,	Rendlesham Hall	·61	,,	Balquhidder, Stronvar..	9·07
,,	Diss	1·25	,,	Coupar Angus Station..	1·76
,,	Swaffham	1·02	,,	Dunkeld, Inver Braan..	2·81
V.	Salisbury, Alderbury...	1·12	,,	Dalnaspidal H.R.S. ...	7·85
,,	Warminster	...	XVII.	Keith H.R.S.	2·10
,,	Bishop's Cannings	2·06	,,	Forres H.R.S.	1·27
,,	Ashburton, Holne Vic....	2·86	XVIII.	Fearn, Lower Pitkerrie.	1·39
,,	Okehampton, Oaklands.	3·65	,,	Loch Shiel, Glenaladale	14·85
,,	Lynmouth, Glenthorne.	3·29	,,	N. Uist. Loch Maddy ...	7·15
,,	Probus, Lamellyn	3·47	,,	Invergarry	8·76
,,	Launceston, S. Petherwin	...	,,	Aviemore H.R.S.	2·78
,,	Wincanton, Stowell Rec.	2·54	,,	Loch Ness, Drumnadrochit	3·56
,,	Wells, Westbury.....	...	XIX.	Lairg H.R.S.	...
VI.	Bristol, Clifton	2·33	,,	Scourie	4·73
,,	Ross, The Graig	1·37	,,	Watten H.R.S.	1·62
,,	Wem, Clive Vicarage ...	2·66	XX.	Dunmanway, Coolkelure	6·47
,,	Cheadle, The Heath Ho.	1·98	,,	Fermoy, Gas Works ...	3·42
,,	Worcester, Diglis Lock	·91	,,	Darrynane Abbey.....	4·78
,,	Coventry, Coundon	1·43	,,	Tipperary, Henry Street	3·10
VII.	Ketton Hall [Stamford]	1·25	,,	Limerick, Kilcornan ...	2·67
,,	Grantham, Stainby	1·13	,,	Ennis	2·98
,,	Horncastle, Bucknall ...	1·35	,,	Miltown Malbay.....	3·76
,,	Worksop, Hodsck Priory	1·07	XXI.	Gorey, Courtown House	3·10
VIII.	Neston, Hinderton	3·75	,,	Mullingar, Belvedere...	2·68
,,	Knutsford, Heathside...	3·20	,,	Athlone, Twyford	3·26
,,	Lancaster	...	,,	Longford, Currygrane...	2·70
,,	Broughton-in-Furness..	7·19	XXII.	Galway, Queen's Coll...	3·84
IX.	Ripon, Mickley	2·37	,,	Crossmolina, Enniscoe..	5·46
,,	Scarborough, West Bank	1·59	,,	Collooney, Markree Obs.	2·62
,,	East Layton [Darlington]	1·88	,,	Ballinamore, Lawderdale	3·18
,,	Middleton, Mickleton..	3·09	,,	Lough Sheelin, Arley ..	2·47
X.	Haltwhistle, Unthank..	4·69	XXIII.	Warrenpoint	2·18
,,	Bamburgh.....	2·20	,,	Seaforde	2·16
,,	Shap, Copy Hill	...	,,	Belfast, New Barnsley..	3·16
XI.	Llanfrechfa Grange	1·96	,,	Bushmills, Dundarave...	2·56
,,	Llandovery	4·62	,,	Stewartstown	2·53
,,	Castle Malgwyn	3·71	,,	Buncrana	2·95

SEPTEMBER, 1891.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date	Min. Deg.	Min. Date	No. of Nights below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·03	— 1·48	·17	14	15	80·4	13	43·3	24	0	0
II.		Maidstone (Hunton Court)...	·94	— 1·65	·25	21	13	...	...	...	...	...	...
,,		Strathfield Turgiss	1·79	— ·66	·32	19	20	80·4	12	41·5	20	0	0
III.		Hitchin	·87	— 1·63	·23	30	14	81·0	11	42·0	24	0	0
,,		Winslow (Addington)	·88	— 1·79	·14	18*a*	14	81·0	11	40·0	15*f*	0	0
IV.		Bury St. Edmunds (Westley)	1·16	— 1·54	·27	14	11	71·0	11	45·0	22	0	...
,,		Norwich (Cossey)	1·06	— 1·60	·45	14	9	81·0	12	...	...	...	...
V.		Weymouth(LangtonHerring)	2·31	— ·11	·97	13	15	70·0	11*c*	46·0	23	0	0
,,		Barnstaple.....	3·18	— ·31	·60	17	15	80·0	13	41·0	3, 4	0	...
,,		Bodmin (Fore Street)	4·13	— ·34	·63	18	21	...	...	...	...	...	...
VI.		Stroud (Upfield)	1·79	— 1·12	·28	6	19	78·0	11*d*	44·0	3, 6*j*	0	0
,,		ChurchStretton(Woolstaston)	3·60	+ 1·10	1·03	19	18	77·0	11	43·0	22	0	0
,,		Tenbury (Orleton)	1·32	— 1·29	·40	19	11	81·0	10	37·0	7	0	0
VII.		Leicester (Barkby)	1·18	— 1·46	·42	21	12	82·0	10	36·0	2	0	0
,,		Boston	·59	— 2·18	·25	21	11	?90·0	10	42·0	3, 15	0	0
,,		Hesley Hall [Tickhill].....	·94	— 1·22	·24	21	10	84·0	11	38·0	24	0	...
VIII.		Manchester(PlymouthGrove)	3·00	— ·47	·53	19	18	82·0	11*e*	42·0	2	0	...
IX.		Wetherby (Ribston Hall) ...	1·60	— ·86	·51	20	7	...	...	...	...	...	...
,,		Skipton (Arncliffe)	4·62	— ·14	·68	5	22	81·0	11	43·0	20	0	...
,,		Hull (PearsonPark)	1·19	— 1·25	·34	21	16	82·0	10	43·0	24	0	...
X.		Newcastle (Town Moor)	2·62	— ·16	·48	20	14	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	20·86	+ 9·13	4·58	5	21	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	2·76	— ·98	·45	3	18	...	...	...	...	...	...
,,		Haverfordwest	4·49	+ ·09	·62	20	20	71·9	13	37·1	7	0	...
,,		Carno (Tybrith)	3·83	+ ·06	·77	19	18	67·0	10	38·0	23	0	...
,,		Llandudno.....	3·94	+ 1·72	·97	30	14	81·1	10	47·4	3	0	0
XII.	SCOTLAND.	Cargen [Dumfries]	4·81	+ 1·25	·98	5	16	79·0	13	35·4	23	0	...
,,		Jedburgh (Sunnyside).....	4·29	+ 1·60	1·12	20	19	75·0	12*e*	37·0	23	0	...
XIV.		Old Cumnock	5·65	+ 1·82	·89	20	24	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	7·51	+ 2·38	·70	1, 25	23	...	...	38·0	22	0	...
,,		Oban (Craigvarren)	7·50	...	·80	10	24	75·4	13	40·5	23	0	...
,,		Mull (Quinish).....	7·11	+ 2·08	·80	25	23	...	...	...	...	...	...
XVI.		Loch Leven Sluices	6·30	+ 3·51	2·10	21	13	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	4·25	+ 1·74	2·05	20	13	79·1	12	41·3	8	0	0
XVII.		Braemar	4·17	+ 1·31	1·28	20	17	75·0	12	30·5	23	...	3
,,		Aberdeen (Cranford)	5·46	...	2·70	20	16	80·0	12	32·0	31	1	...
XVIII		Strome Ferry.....	8·29	+ 3·42	1·00	25	22	...	..	...	...	...	..
,,		Inverness (Culloden)	2·00	— ·45	...	...	...	75·0	12	35·0	23	0	2
XIX.		Dunrobin	1·92	— ·67	·46	2	15	72·5	12	43·0	8	0	...
,,		S. Ronaldsay (Roeberry).....	2·77	+ ·11	·30	5	21	64·0	10	45·0	21	0	...
XX.	IRELAND.	Dromore Castle	2·39	— 1·64	·40	2*b*	11	76·0	16	42·0	15	0	...
,,		Waterford (Brook Lodge) ...	3·01	+ ·09	·59	7	14	73·0	11	38·0	7	0	..
,,		O'Briensbridge (Ross)	2·90	...	·63	5	19	74·0	13	42·0	*g*	0	0
XXI.		Carlow (Browne's Hill)	2·23	— ·59	·35	25	18	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	2·13	+ ·16	·56	19	18	75·8	10	44·8	7	0	0
XXII.		Ballinasloe	2·97	+ ·18	·88	5	22	71·0	11	37·0	22	0	...
,,		Clifden (Kylemore)	8·31	...	·86	5	23	..	...	...	...	...	...
XXIII		Waringstown	2·18	— ·98	·52	5	21	80·0	11	39·0	3	0	...
,,		Londonderry (Creggan Res.).	3·64	— ·14	·48	5, 13	24	...	...	...	...	..	...
,,		Omagh (Edenfel)	4·04	+ ·66	·92	5	21	72·0	11	41·0	6	0	0

a And 22. *b* And 7, 10. *c* And 12. *d* And 12, 13. *e* And 13. *f* And 16. *g* Various.
+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON SEPTEMBER, 1891.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail. S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—September was remarkable for the number of days on which R fell, although the total for the month was below the average. This greatly discomforted the farmers, and did no small injury to the corn, some of which was uncut at the close. From the 8th to the 14th the weather was warm and genial. T on the 22nd.

ADDINGTON.—The least rainfall in any September for the last 20 years. From the 7th to the 14th very fine. On the 22nd a sharp TS, with heavy R; at Winslow H fell freely, but none here.

BURY ST. EDMUNDS, WESTLEY.—A lovely month; fine till the 14th, and very hot for the time of year. T on the 14th.

LANGTON HERRING.—The weather was fine for the first twelve days of the month, and the harvest was secured in a somewhat better condition than was anticipated. Heavy dews on 7th, 8th, 9th and 23rd; foggy on 18th, 19th and 20th; T on 22nd; solar halo on 26th. Mean temp. above the average.

BODMIN.—A cold wet month with high winds on several days. Very bad for the harvest, which was not finished at the close.

WOOLSTASTON.—The month commenced with a heavy gale, and the first week was cold and wet. The 8th was sunny and bright, and was followed by a few days of very hot summer weather, which was the saving of the harvest, and enabled much of it to be gathered in in fair condition. The latter part of the month was again cold and showery. Mean temp. 57°·4.

ORLETON.—A fine warm month, but nearly 1° colder than September, 1890, although 2° above the average. From the 8th to 13th inclusive, very hot; the temp. on 3 days reaching 80°. No frost.

LEICESTER, BARKBY.—A fine warm month; harvest got in well. Some lovely clear nights, as well as days. T on the 26th.

MANCHESTER, PLYMOUTH GROVE.—Mean temp. 57°·1. Summer weather prevailed on the 2nd and 3rd, also from 8th to 13th. The remainder of the month was very unsettled.

HULL, PEARSON PARK.—Thunderstorms on 4th and 14th.

WALES.

HAVERFORDWEST.—Although so much R fell and there were so many rainy days, still the fall often taking place during the night, there were many more fine days than the figures show. The month generally was warm, day and night; no frosts occurred. The finest and warmest weather prevailed from the 9th to the 17th, during which the temp. was 70° and upwards, the sky cloudless, and the hygrometric condition of the air damp, with heavy night dews, which lay in shaded places all day. Strong winds from the West and South-West prevailed, reaching the force of a gale on one or two occasions.

SCOTLAND.

CARGEN.—The weather during the month was extremely unsettled, and the harvest operations were greatly interfered with. In the higher part of the district a good deal of grain was still out in shocks at the close, and very much deteriorated. Strong gales were experienced on the 21st and 28th. T on the 4th.

JEDBURGH.—The weather was very unsettled, with much R and high winds and occasional low temp. The harvest was much retarded, and there is still much corn in the field, on some of the higher districts. Gale with R all day on the 1st; high winds on the 20th and 21st, with 2·12 in. of R in the two days.

OLD CUMNOCK.—On the 6th ·23 in. of R and H fell in 10 minutes.

OBAN.—R very constant throughout the month, with a normal temp., which,

however, rose considerably about the middle. *August record*—total R 6·29 in. on 24 days; max. fall 1·15 in. on 31. Max. temp. 67°·0 on 7th and 22nd; min. 42°·9 on 30th.

MULL, QUINISH.—A wet and stormy month, but most of the grain in this district was secured in good order during the third week, thanks to four days of sunshine and strong N. wind

ABERDEEN, CRANFORD.—In 36 hours, on 20th and 21st, 3·85 in. of R fell.

CULLODEN.—Little R fell in the first half of the month, but on the 20th and 21st there was a good deal of flooding. Notwithstanding the state of the weather, the harvest generally was favourable.

IRELAND.

WATERFORD, BROOK LODGE.—Mean temp. 56°·3. Thick fog in early morning on the 7th, and fog on 8th. Summer weather on 10th, 11th and 12th.

O'BRIENSBRIDGE, ROSS.—A few splendid days from the 9th to the 14th, and some others at intervals of broken weather, made up a fairly good harvest season. Heavy gale from S.E. on the 25th.

DUBLIN.—September was a fine month in comparison with August, but both at the opening and close the weather was particularly unsettled, showery and squally. A period of beautiful summer-like weather occurred in the week ending the 12th, and as a whole the month was marked by a high temp., and an overwhelming prevalence of south-westerly winds. Mean temp. 57°·6, 1°·8 above the average. High winds on 14 days, attaining the force of a gale on four occasions—1st, 21st, 26th and 30th. Solar halo on 19th; lunar halos on 16th and 18th; T and L on 13th; auroræ observed on the 2nd, 9th and 11th; fog on the 10th.

WARINGSTOWN.—Four days of very unusual heat occurred, the max. temp. being on the 10th, 78°; 11th, 80°; 12th, 79°, and 13th, 77°.

EDENFEL.—The first week was a continuance of the rainy weather that prevailed throughout August, but on the 9th summer, with all its characteristics suddenly returned, and although the weather again became fresh and somewhat unsettled on the 13th, it did not wholly break till the end of the month, and as a result a good average harvest was for the most part gathered in fair order.

EXCESSIVE RAIN IN THE ENGLISH LAKES.

To the Editor of the Meteorological Magazine.

SIR,—The rainfall here in the past two months has been so remarkable that you may think it worth notice. I have a rain gauge which has now been kept for 26 years, and I give you the results of observations:—

	Average, 26 years.	Maximum.	Rainfall in 1891.	Excess over average.
August	4·55 in. ...	8·55 in. ...	11·93 in. ...	162 per cent.
September ...	5·33 in. ...	11·49 in. ...	8·61 in. ...	61 per cent.
Aug. & Sept. together	9·88 in. ...	17·16 in. ...	20·54 in. ...	108 per cent.

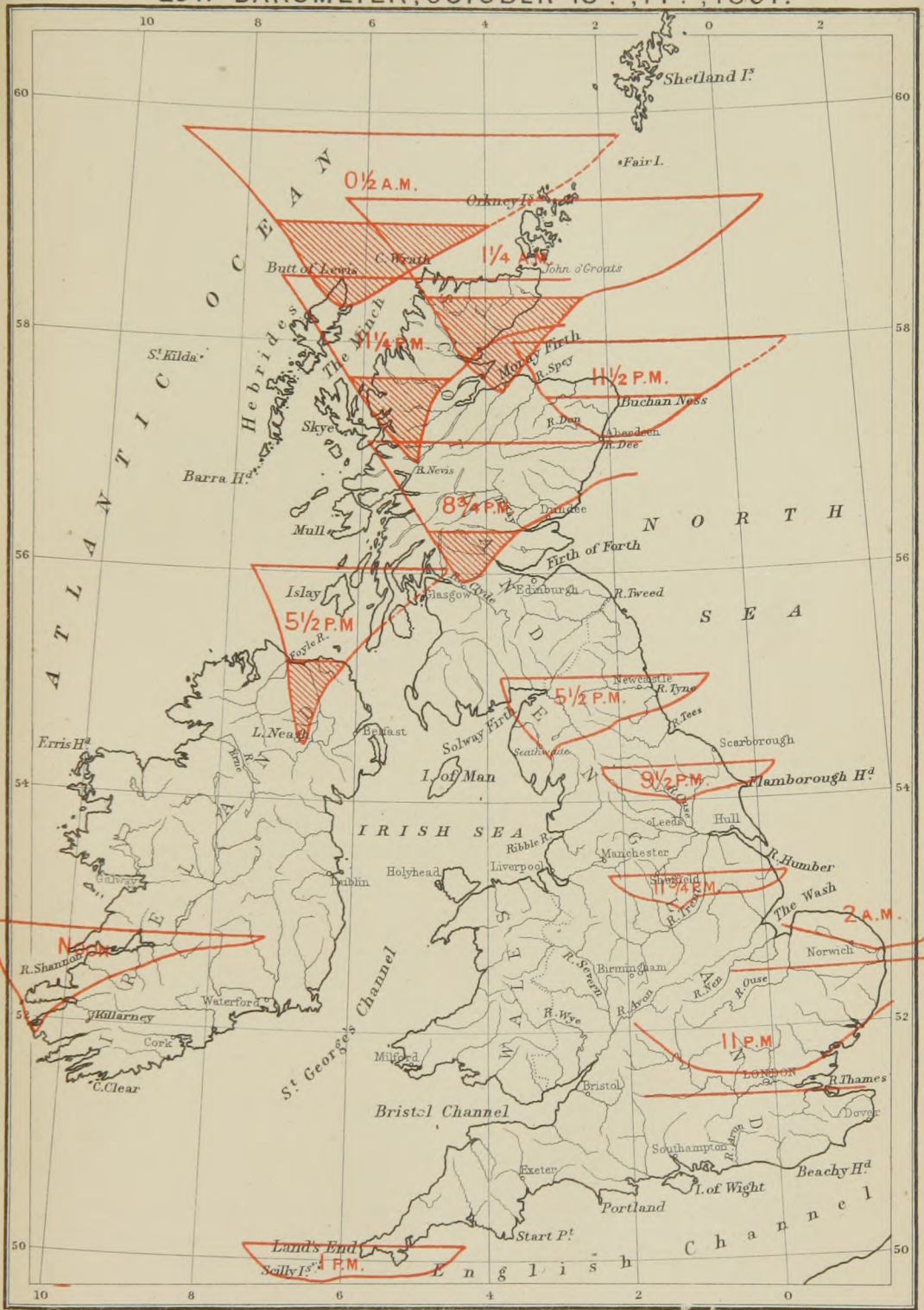
At the same time it should be noticed that the total rainfall for nine months of this year is 38·37 in., or only 4 per cent. more than the average for that period, which is 36·86 in.

The year 1891 is therefore a marked instance of the uncertain and bad weather in the Lake country in early autumn, when tourists mostly come here, as compared with spring and early summer.

JOHN MARSHALL.

Derwent Island, Keswick.

LOW BAROMETER, OCTOBER 13TH, 14TH, 1891.



Stanford's Geogl. Estabt. London.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCCX.] NOVEMBER, 1891. [PRICE FOURPENCE, or 5s. per ann. post free.

LOW BAROMETER ON OCTOBER 13TH—14TH, 1891.

THE pressure at sea level having at 1.15 a.m. on October 14th fallen, at Cawdor Castle, Nairn, N.B., below 28 inches, the Earl of Cawdor was good enough to send us the tracing of his Richard barograph. We compared it with the sea level pressure at Nairn, as recorded at 8 a.m. and 6 p.m. in the Daily Weather Report, and found that the instrument was working perfectly. We thus had a record for the night hours during which the very low pressure occurred. Having shown it to Mr. R. H. Scott, F.R.S., he very kindly gave us tracings from the records of the Richard aneroids at Valencia, Scilly, Stornoway, Aberdeen, and Yarmouth, also a series of readings taken at short intervals at Lissan, Cookstown, co. Tyrone, by Sir N. Staples, Bart. These we have reduced approximately to sea level values, and plotted on the same scale as the others.

Having this material, the question arose how to utilize it best. The accompanying plate is the solution which we offer. The horizontal line for each station represents 29 inches, and the curve the variations of pressure below that point; where the pressure fell below 28½ inches the space below it is shaded. The lowest point of the curve—*i.e.*, the lowest sea level pressure—is placed over the position of the station. The time of occurrence of the minimum is marked in figures; all those entered as p.m. refer to October 13th, all a.m.'s to the 14th.

Having drawn these curves, we found that a few others were needed to complete the series. We therefore asked Mr. S. A. Marshall for the sheet from his barograph at Skelwith Fold, Ambleside, in the English Lakes; Mr. J. E. Clark for the one from Bootham School, York; and Mr. Paget for that from Stuffynwood Hall, Mansfield, Notts, and Mr. Scott has subsequently supplied the hourly readings from the photographic barographs at Fort William and Glasgow.

It should be understood that considerable as was this depression, it is not to be regarded as unique. In London there is no record of a sea level pressure of 28 inches this century; in fact, we do not know of the pressure in London ever falling to that point, but in the West and North of Ireland, and in Scotland, there are many such cases on record. Still, it is by no means every year in which so

interesting a diagram could be drawn. The sharpening of the curve at Lissan, as compared with Valencia, is curious; and before the depression had left Scotland it was again filling up. The following table summarises the principal features in the curves:—

County.	Station.	Hours below 29·0	Hours below 28·5	Minimum. Pressure.	Minimum. Time.
Ross	Stornoway	34 ...	16 ...	28·05	0.30 a.m.
Nairn	Cawdor Castle...	32 ...	13 ...	27·96	1.15 a.m.
Aberdeen ...	Aberdeen	22 ...	12 ...	28·49	11.25 p.m.
Inverness ...	Fort William ...	? ...	8 ...	28·01	11.8 p.m.
Lanark	Glasgow	? ...	7 ...	28·24	8.43 p.m.
Tyrone	Lissan	16 ...	6 ...	28·04	5.30 p.m.
Lancashire...	Ambleside	16 ...	0 ...	28·61	5.30 p.m.
York	York	13 ...	0 ...	28·83	9.30 p.m.
Notts	Mansfield	14 ...	0 ...	28·86	11.45 p.m.
Norfolk	Yarmouth.....	0 . .	0 ...	29·10	2 a.m.
Kerry...	Valencia	22 ...	2 ...	28·44	Noon.
Middlesex ...	Camden Square	0 ...	0 ...	29·08	11 p.m.
Cornwall ...	Scilly..... ..	15 ...	0 ...	28·80	1 p.m.

The rate of fall was rapid both at Lissan and Glasgow, being nearly 0·20 in. per hour, but the feature which strikes us as most remarkable was the rise at Fort William—the readings reduced to 32° and sea level give :—

11 p.m.....	28·030 in.
11.8 p.m.	28·014 in.
Midnight	28·260 in.

This gives a rise of 0·246 in. in 52 minutes, or 0·284 in. per hour.

Of course, the shape of these curves shows how steep the gradients must have been, and therefore, that a heavy gale must have prevailed —which was the case; buildings were destroyed, ships wrecked, lives lost and trees uprooted, the worst damage being in the N. of England and Ireland, and in the S.W. of Scotland.

THE BAROMETRIC DEPRESSION OF NOVEMBER 11, 1891.

SINCE the foregoing article was prepared, another considerable depression has passed over the British Isles. As the foregoing table shows, the pressure at sea level on October 14th was at Cawdor Castle only 27·96 in.; whereas in the depression on Nov. 11th, we have not yet heard of any lower pressure than 28·31 in., which occurred at Shields at 6 p.m

As, however, this depression passed several hundred miles south of the October one, the readings were at southern stations very unusual—*e.g.* in London the pressure at sea level has, since 1858, fallen only five times below 28½ inches, viz. :

1872	Jan. 24..	4.47 a.m.	28·332 in.	1876	Dec. 4...	11.0 a.m.	28 364 in.
1873	Jan. 20..	1.0 a.m.	28·447 in.	1886	Dec. 9...	4.45 a.m.	28·295 in.
1876	Mar. 12.	0.30 p.m.	28·447 in.	1891	Nov. 11	11.45 a.m.	28·456 in.

This depression, though important, and accompanied by a destructive gale, was of course less noteworthy than that of December 9th, 1886. We are, however, not aware of any more rapid rise in London, than that between 2.30 and 3.30 p.m. on Nov. 11th—viz. : 0·155 in., of which 0·090 in. occurred between 3 and 3.30 p.m.

METEOROLOGICAL BIBLIOGRAPHY.

I AM sorry that I have not yet received a single note with reference to the article in the September number. This may have arisen from either of the following causes :—(1) Agreement with the views therein expressed; (2) Apathy.

Meanwhile it is very curious that in the October number of *The Observatory* there is an excellent article upon "Astronomical Bibliography," by Dr. J. L. E. Dreyer, F.R.A.S., which is in fact a review of the very important catalogue of the Crawford library recently published,* for a copy of which I am indebted to Dr. Copeland, the Astronomer Royal for Scotland.

As regards Dr. Dreyer's article, it in no respect runs counter to the views I expressed in September, but it reminds me of one point which I omitted to mention. Dr. Dreyer draws attention to the superiority of entries made direct from the books over those copied second-hand. On the cards which I sent to Washington, letters were placed indicating (whenever it was known) in what library each book existed. In the type-written edition this information was not given; evidently it should be in the complete edition.

It may be well to clear up a point upon which Dr. Dreyer has the following foot-note :—

"After a very extensive use of the [Crawford] Catalogue, I have only found one single error in it, viz. : on p. 237. The book of which the title is given under the name of Hippocrates is not by that author, but the last seven pages of the book are taken up by *Hyppocratis libellus de medicorum astrologia.* Lalande made two different books of this very scarce and interesting old book, of which I rejoice in the possession of a copy."

Considering that I also have a copy, we must perhaps not say very much of its scarcity, though I know of no others; but I refer to it to state what was unknown to Lalande and also both to the compiler of the Crawford catalogue and to Dr. Dreyer, viz., the name of the author of this anonymous book. It was printed at Venice in 1485, and being therefore before title pages had been thought of, begins with a heading "*Opusculū repertorii pronosticon in mutationes aeris, tam via astrologica quam metheorologica,*" &c., and has no name or signature whatever. But in 1539 Kerver, of Paris, issued in 4to *Firmini repertorium de mutatione aeris, tam via astrologica, quam metheorologica, pristino nitori restitutum,* per Phillippum Iollainum Blereium, cum scholiis eiusdem. This is a verbatim reproduction of the text of 1485, with elaborate commentaries. Therefore the early part of the volume referred to by Dr. Dreyer is by Firminus, and the latter part is a translation into Latin by Peter de Abbano of part of the writings of Hippocrates.

I have only, in conclusion, to say a few words about the handsome *Crawford Catalogue.* I wish that the personal element could be

* *Catalogue of the Crawford Library of the Royal Observatory, Edinburgh.*— Edinburgh. Published by authority of H.M. Government, 1890. 4to, viii., 498 pages.

weeded out of catalogues. The Crawford library was a splendid present to the Royal Observatory, Edinburgh, and doubtless the Astronomer Royal for Scotland felt shy at omitting to catalogue every paper in it; but the result is that the volume contains many titles which have not the slightest relation to astronomy. It is the same difficulty which Dr. Neumayer had to meet in the Hamburgh library. It is to be hoped that the time will come when it will be realized that the value of a library is *diminished* by every book which it contains that does not help to forward the subject to which the library is devoted. What conceivable astronomical interest can attach to the following :—

> HILL, ROWLAND : Requisites to the completion of Mr. Rowland Hill's plan of Post Office Improvement.—No. 1. 14 pp. 8vo. London, 1843.

This is, however, my only complaint against a work which is a credit to everyone concerned —a heavy task excellently accomplished.

G. J. S.

THE MUNICH CONFERENCE.

Dr. Erk has issued a very interesting little paper* which not merely summarizes the work of the recent Conference, but explains in a popular manner the need for such gatherings. He points out that the Meteorology of one country depends so much upon that of surrounding ones, that it is only by International exchanges that any phenomenon can be thoroughly traced, and that this cannot easily be done unless the mode and time of observation, and of publishing the data, are nearly identical in all countries. He shows how thoroughly this was recognised in the organization of the Meteorological Society of the Palatinate in 1780, but we do not agree with Dr. Erk that that Society came to an end in 1791 in consequence of the war ; we believe that its eventual collapse was due to the death of its Secretary, Hemmer. Then Dr. Erk passes on to the meeting of the British Association at Cambridge in 1845, to the congress (originated by Maury) and held in 1853, at Brussels, a congress which as regards Nautical Meteorology, left little to be reconsidered in subsequent years.

He next passes to the suggestion of an International Congress for Land Meteorology, and attributes the origination of the idea to M. Marié Davy. Following up Dr. Erk's references, we have found that M. Marié Davy's report was printed *in extenso* in the *Annuaire Soc. Met.* de France, xvi. (1868) pp. 180-188. M. Marié Davy had been charged by the Minister of Public Instruction with a mission to visit and report upon the Meteorological Observatories and

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* Die Internationale Conferenz der Repräsentanten der Meteorologischen Dienste aller Länder in München (26 August bis 2 September 1891). Von. F. ERK. 8vo., 28 pages. J.B. Cotta, München, 1891.

Organizations of South-eastern Europe, and to his report he attached important remarks, which may be thus epitomized :—

"The meteorologists whom I have had the honour of meeting have been unanimous in recognizing the needs of modern meteorology, increased accuracy, more stations, not the study of one climate, nor even of grouped means, such as have been used by Maury, Quetelet, Dove and others, but of closer relations between the meteorologists, more uniformity in the modes of observation, and of publication.

"In the atmosphere which surrounds us everything is linked together. It is not sufficient to state isolated facts, they must be co-ordinated so as to trace their causes and their laws, and thence infer their return and their future effects. General studies of the facts of single days can alone help forward this work, and for it all available data must be collected and co-ordinated. Each meteorologist having before him the data for each day (and if possible the same hour of the day) for the whole globe could study them in such manner as he thought fit, and the collected result of such studies could not fail to advance the science.

"The Brussels Congress contributed powerfully to the formation of modern meteorology, and it is generally felt that a fresh one should complete the work so well begun. Why should not the model of the Statistical Congress be followed, and a *Congrés permanent de la physique du globe* be established, composed of delegates from all nations, who should meet once each year—sometimes in one capital, sometimes in another—to discuss instruments and methods of observation, publications, the results obtained both as to theory and practice, points to which the attention of observers should be directed, &c."

"The globe belongs to all the nations, all have equal interests in uniting to obtain a complete knowledge of their common property."

This report is dated Nov. 22, 1868.

In July 1869, Drs. Jelinek and Hann gave the first place in the *Zeitschrift* to an article by Dr. Jelinek upon M. Marié Davy's suggestion, and mentioned that when the International Statistical Congress met at Florence in 1867, a proposal was made as to a more liberal exchange of meteorological publications, the Austrian Meteorological office was able to say that they were already doing all that was possible, and that when in the summer of 1868 there was some talk of a general meeting of the Directors of Meteorological systems, the Austrian Government at once stated that they would bear the cost of sending their Director

The next person to take prominent action in the matter was Dr. Wild of St. Petersburg, who inserted at the end of his report for 1870, a plea for an International Congress of Meteorologists.

Finally, in May 1872, Messrs. Bruhns, Wild, and Jelinek issued the invitation which led to the assembly of the Leipzig Conference of August 14th, 1872.

The pamphlet then traces the history of the various Congresses

and Conferences which have since been held. In fact so numerous have they been that practically they have nearly realized M. Marié Davy's suggestion of an annual meeting.

The Munich Conference was well attended—in fact there were over 30 persons present at each meeting, and nearly half of them may each be described as the leading meteorologist of his country.

As we understand that Mr. R. H. Scott, F.R.S., who represented the British Isles at the Conference, and was a very active member of it, will, at the next meeting of the Royal Meteorological Society, report what was done at Munich, and it will be our duty to give an abstract of his remarks in these pages, we do not here deal with the remaining ten pages of Dr. Erk's pamphlet, as the only result would be useless repetition.

HELIGOLAND.

ENGLAND long possessed this little island, but although for nearly twenty years observations were made there three times a day, we are not aware that either the Meteorological Office, or the Colonial Office, or any other Government Department, had them worked up, or rendered available to the British public. The observations were published *in extenso* in the *Ergebnisse der Beobachtungs stationen an den deutschen Küsten*, but we doubt if even this fact was generally known.

Heligoland has now very properly been transferred to Germany, and already we have in the October number of *Das Wetter* an article extending over 11 pages, and giving a general and popular account of the climate, and information as to what the Prussian Meteorological Institute has done towards obtaining further records.

Special attention is drawn to the mildness of the winters as compared with those at stations on the mainland, and to the fact that roses may often be seen in bloom in December. In the spring, however, the temperature is kept low by the surrounding water, and the mainland stations are the warmer. In connection with this it may be well to give the mean temperature of air and sea :—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Air.	34·9	34·7	36·1	42·3	49·5	56·8	60·4	61·2	57·7	50·0	42·6	37·6	46·9
Sea.	38·7	36·9	37·4	41·2	47·1	54·7	59·9	63·0	61·2	55·4	48·7	43·5	48·9
Diff.	—3·8	—2·2	—1·3	+1·1	+2·4	+2·1	+0·5	—1·8	—3·5	—5·4	—6·1	—5·9	—2·0

Dr. Kremser then goes on to deal with humidity, cloud, fog, rain (average about 30 inches), and other elements, and finally he states that the Prussian Government has not merely thoroughly equipped the station as a 2nd order one, but has added a thermograph and a sunshine recorder.

INSIDE A WATERSPOUT.

[THE following remarkable narrative appears in the November number of the *Leisure Hour*. As far as we are aware, the experience is unique. H. A. is apparently not a skilled meteorologist, and in some respects that is fortunate, as otherwise his report might have been quite unconsciously (especially after the lapse of 35 years) coloured by his knowledge of what ought to have happened. Hence the importance of his remark, "My sensation was that of being drawn aloft with the spiral motion of the spray and water."

It is to be hoped that now that the Richard recording aneroids are being so widely used, a waterspout or a whirlwind may go over one of them, and so teach us the amount of the up-draught. It is most fortunate that the *Leisure Hour* has gathered this useful note. —ED.]

WATERSPOUT.

"The reference in a recent number of the *Leisure Hour* to the narrow escape of the steamship 'America' from collision with a waterspout reminds me," writes a correspondent, "of my experience of one, which goes to prove that they are not all as solid and dangerous as they look.

"In 1855 I was a young officer on board the pretty clipper ship 'Crest of the Wave' (No. 37 transport), on her way to the Crimea laden with war material.

"One calm morning, when nearing the Grecian Archipelago, I was busy washing decks, until startled by a cry from the forecastle. I looked ahead, and saw bearing down upon us a huge waterspout, with its head in the clouds and its base spread over a large circle of foam and spray, a revolving, seething mass of water. I quickly called the captain, who took in the position at a glance, and the 'let go everything' was followed by the rapid downfall of top-gallant sails and topsails, &c. Just in time! for with a rush both wind and water were upon us.

"The spout did not rake us fore and aft, but zigzagged across the ship passing athwart the forecastle, then back again over amidship, and a final track along the poop, passing right over me as I stooped to clear the mizzen topsail haulyards. For a few moments my sensation was that of being drawn aloft with the spiral motion of the spray and water, not in the least that of being crushed to the deck by a heavy volume of water.

"Shaking myself like a Newfoundland dog, when I recovered from the shock, I had a good view of what was passing on the main deck, which was flooded.

"I had seen the men flying before the advancing spout from side to side, tumbling over one another, and over spars and floating casks; and now I was able to laugh, as I witnessed their efforts to regain their legs and free themselves from the rush and swirl of water caused by the roll of the ship.

"We escaped without injury to ship or crew, which was wonderful, considering the height of the sea sucked up by the spout, and the violence of the accompanying whirlwind.

"I have often wondered how many recorded instances there are of the actual impact of a waterspout with a ship, and whether there are any of a crew escaping with a fright and a bath!

"H. A."

A WEATHER ANALYSIS FOR FIVE YEARS, 1886–90.

It may be interesting to some (especially those engaged in farming operations) to know the number of fine or wet days that may be expected in an average year. In order to effect this object, I have deduced the following summary from daily weather charts kept in North Sussex, and 372 feet above sea level.

	Very Fine.	Fine.	Fair or Cloudy.	Wet.	Very Wet.
1886	51	90	114	93	16
1887	50	103	151	52	9
1888	45	77	155	73	16
1889	57	83	134	80	12
1890	60	102	123	68	12
Average ...	53	91	135	73	13

It will be necessary, in order to properly appreciate the above table, to define what is understood by a very fine day, wet day, &c.:

Very Fine.—Almost cloudless, sunshine throughout.
Fine.—More sunshine than cloud.
Fair or Cloudy.—Dull or cloudy, but no rain.
Wet.—Generally rainy or very showery.
Very Wet.—Persistent heavy rain.

The averages above may be taken as a fair reckoning of the conditions for the Southern Counties of England. It will be noticed that the years vary to some extent, but in the period chosen, each year differed materially in character from its neighbour. 1886 was very wet; 1887 noted for a great drought, &c.

I will now compare the months, giving the *aggregate* returns for five years, as the individual years (though interesting) would occupy too much space. For the sake of brevity, also, the fine and very fine, and wet and very wet days, may be classed together thus :—

	Fine & very Fine.	Fair or Cloudy.	Wet & very Wet.	Total Days
January	41	79	35	155
February.....	44	69	28	141
March	46	59	50	155
April	53	59	38	150
May.....	79	50	26	155
June	80	43	27	150
July...	67	46	42	155
August	69	49	37	155
September	84	39	27	150
October	76	45	34	155
November	38	64	48	150
December	41	75	39	155
Average per annum	144	135	86	365

Here it will be seen at once that—

Most fine days occur in September, June, May, and October.
Fewest ,, ,, November, December / January } equal

Also that—

Most wet days occur in March, November, July and December.
Fewest ,, ,, May, June / September } equal, and February.

These results may in some instances be contrary to general belief, and certainly it seems strange that March should have most wet days, and May the fewest; and this goes far to prove the fallacy of trusting to short periods of time. The case in point, however, may admit of explanation, being the result of an abnormal rainfall in 1888. Most of the other months (both fine and wet days) seem to agree closely with expectation or experience, and no further comment is needed when the facts are stated.

A. F. PARBURY.

Headley, Hants, September, 1891.

AN ENEMY TO HYGROMETRIC OBSERVATIONS.

MANY years ago—in our first volume, that for 1866—the Rev. C. H. Griffith (on p. 66) called attention to "A new enemy to rain gauges," viz., the leaf-cutter bee, of which he had found nine nests in the tube of one rain-gauge, nearly closing it up.

The October number of *Das Wetter* reports an analogous case with reference to a Saussure's hygrometer, in which a hair (by its variation in length) indicates variation in the humidity of the atmosphere. A spider thought that the hair would make a good basis for one of the chief supports of its web, but by putting this lateral strain on the hair the indications of the hygrometer were necessarily rendered erroneous.

THE RAINFALL OF OCTOBER, AND OF THE FIRST TEN MONTHS OF 1891.

MR. SYMONS'S letter to the *Times* inserted November 6th being too long for reproduction here, we quote the principal statements, and add values received since that letter was written.

"The floods in some parts of England having again brought the subject of rainfall prominently forward, I herewith submit an epitome of the facts as at present reported.

"As regards the rainfall in London, my own record goes back to January 1858, and the wet Octobers have been :—

October, 1865	6·22 in.
October, 1872	5·20 in.
October, 1880	5·78 in.
October, 1882	4·96 in.
October, 1891	4·80 in.

Therefore, as far as London is concerned, a fall as large as, or larger than, that of October, 1891, occurs about once in seven years, and there is nothing very exceptional in the recent fall in the metropolis; and as compared with the average for the month—and October is usually the wettest month in the year—it is only 66 per cent. above it.

"The exceptional feature, as far as the metropolis is concerned, has been the excess of three out of the last four months, so that we have had :—

—	1891	Average.	Excess in 1891.		Greatest previously.
			Amount.	Per Cent.	
July to October inclusive.....	in. 14·40	in. 9·96	in. 4·44	44	15·38in. in 1880

This shows that we have had during the last four months nearly half as much again as our average, and nearly as much as in the wettest corresponding period during 34 years. If to this be added the fact that, out of the 123 days, rain fell on 74, it will be understood that the weather in the metropolis has not been pleasant."

The letter then gave a tabular statement, of which, as regards October, the majority of the values are given in the tables in this magazine, and as regards the ten months, was a summary of the similar tables for the ten months of the present year.

This was followed by a series of remarks by observers, many of which are re-produced under the heading of Meteorological Notes on October on p. 159. The letter concluded as follows :—

"From the foregoing table and remarks it will be seen that the fall has been exceptionally large during October over the southern half of England and the whole of Wales, and that at many stations it has been without precedent for a quarter of a century.

"As regards the total for the ten months of the present year, it must be remembered that February was as exceptionally dry as some of the subsequent months have been wet. The early part of the year was generally dry, but we have had a wet July, wet August, and wet October, which have left us at the end of the tenth month with no departure from the average of an important character. The aggregate is in no way exceptional, but the irregularity of the distribution has caused trouble and loss, especially to those who were not prompt to seize such dry periods as did occur."

Muswell-hill.—The total for the month, 6·00 in., is greater than that of any other October since the gauge was started in 1872.

Keston Tower.—Total, 6·87 in., greater than in any month in my record; the next highest is 6·62 in. in Oct., 1882.

Crowborough, Sussex.—Total, 9·28 in. The record goes back to 1871, and the greatest in October previously was 8·30 in. in 1882.

Redlands, Emsworth.—Largest R, 6·72 in., of any month since record commenced in 1884.

Ivy Bank, Southampton.—Total, 9·36 in. The record commenced in 1878, and the greatest in any month previously was 7·20 in. in December, 1886.

Red Lodge, Southampton.—R, 9·18 in., most unusual. I have looked back 20 years in my register, and can find no single month to approach this October in quantity.

Hinton, Alresford.—Total, 11·22 in. The record goes back 11 years, and the greatest previous fall was 6·30 in. in October, 1889.

Ashdell, Alton.—R, 9·07 in. The wettest month for 25 years; the next wettest was 8·14 in. in December, 1869.

Kensworth, Herts.—Total, 8·31 in. Record goes back 25 years, and the wettest previous October was 1882, 6·80 in.; the wettest previous month was July, 1889, 6·86 in.

Great Marlow.—Total, 9·03 in.; the greatest in any month for 13 years.

Newport Pagnell.—Total, 6·00 in. Record goes back 21 years; the wettest October previously was 1880, 5·54 in., and the only wetter month was July, 1880, 6·27 in.

Castle Ashby, Northampton.—Total, 6·33 in.; the greatest in any month since I began observing in 1873.

Alconbury.—Total, 5·39 in. This has been the wettest October for 8 years.

Fulbourn Asylum, Cambridge.—R (5·43 in.) excessive; the most ever recorded here in October.

Bishop's-hill, Ipswich.—Total, 4·69in.; the greatest in any month for 20 years.

Northlands, Salisbury.—Total R, 10·40 in. During the time that I have been an observer (24 years) the fall for one month has never previously exceeded 8·25 in. in 1876.

Heatherlands, Parkstone.—R for Oct. (8·80 in.) is more than 2½ times the mean of the previous 9 years, during which I have taken observations.

Babbacombe, Torquay.—Total, 10·37 in.; the maximum in October, and indeed in any month since observations began in 1876.

Holne Vic., Ashburton.—Total, 15·24 in.; 4 falls of over 1 in. and 2 falls of over 2 in. of R.

Stowell Rect., Somerset.—Total, 8·57 in.; the greatest monthly fall since 1876.

Wells.—Total, 7·95 in. The heaviest fall registered since 1878, except August, 1881, and July, 1882. The moor lands between Wells and Burnham flooded, and many families obliged to leave their cottages in boats.

Harptree Court, Somerset.—Total, 10·04 in.; wettest month since record began in 1882.

Clifton, Bristol.—Total, 8·49 in.; the wettest month for 39 years, except August, 1865, 8·51 in.

Cirencester.—Total, 8·46in.; the greatest record here since November, 1852, 8·95 in.

The Graig, Ross.—Total, 6·70 in. I have not previously registered 6·00 in. in October. In 1843, 6·28 in. was gauged at another station in Herefordshire, which is the heaviest fall recorded in October since 1818.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, APRIL, 1891.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	66·3	28	28·1	1	53·7	36·6	36·3	73	111·3	21·9	1·13	9	6·1
Malta	84·5	9	49·0	23	67·0	53·7	51·0	77	144·5	41·7	1·18	11	4·7
Cape of Good Hope	93·7	10	43·5	25	72·5	54·8	...	...	...	...	2·94	5	...
Mauritius	81·0	4	68·7	26	79·4	71·8	68·5	80	131·9	57·3	7·23	20	6·8
Calcutta	102·7	14	68·1	1	96·8	76·2	73·4	68	158·5	59·1	·54	3	2·3
Bombay	90·7	17	72·8	3	87·2	76·5	73·0	75	139·0	59·7	·00	0	2·0
Ceylon, Colombo	89·9	20	71·6	...	88·1	74·8	72·7	77	148·0	64·5	5·93	18	4·6
Melbourne	82·5	6	41·0	26	66·2	50·0	49·2	73	131·5	30·0	2·41	11	6·5
Adelaide	87·5	10	44·5	30	71·8	54·7	49·6	61	154·0	33·2	·85	8	5·4
Tasmania, Hobart	72·0	10	38·2	25	60·9	46·2	46·9	76	127·0	31·0	1·56	15	6·5
Wellington	69·0	3,4*a*	43·0	7, 27	62·5	50·3	51·6	84	122·0	35·0	5·34	14	4·0
Auckland	73·0	3	48·5	27	65·5	54·0	52·0	76	132·0	41·0	3·63	15	6·0
Jamaica, Kingston	89·1	25	68·4	2, 3	86·3	71·9	68·5	70	...	...	1·25	...	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	77·5	22	20·5	6	52·1	34·8	35·4	71	...	9·0	2·31	14	5·4
New Brunswick, Fredericton	67·3	28	16·3	1	48·6	29·2	29·0	65	...	...	2·05	20	6·5
Manitoba, Winnipeg	89·6	25	3·0	3	56·4	31·2	35·2	72	...	...	1·14	8	4·2
British Columbia, Esquimalt	62·2	4	32·0	1	54·6	41·1	42·6	83	...	...	2·72	19	7·4

a And 15.

REMARKS.

MALTA.—Mean temp. 58°·9; mean hourly velocity of wind 12·3 miles. The sea temp. rose to 61°·3. TSS on 13th and 28th. L on 24th. J. SCOLES.

Mauritius.—Mean temp. of air 0°·9 below; dew point 0°·4 above; R 1·51 in. above, their respective averages. Mean hourly velocity of wind 10·5 miles, or 0·3 below average; extremes, 26·7 on 14th and 1·9 on 1st and 20th; prevailing direction S.E. by E. L on 2nd, T and L on 3rd and 12th, and T on 10th, 19th, and 20th. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—TSS occurred on 10 days, and L alone was seen on 8 days. J. C. H. CLARKE, Lieut.-Col., R.E.

Melbourne.—Mean temp. of air 0°·9, and of dew point 0°·2 below the average. R ·14 in., humidity 1, and cloud 0·6 above the average. Prevailing wind S. to S.E.; strong on 5 days. Heavy dew on 16 days. Fog on the 29th. L on the 11th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 1°·2, and R ·81 in. below, the average of 34 years. C. TODD, F.R.S.

Wellington.—The first few days were fine, then 1·76 in. of R fell on night of 3rd, and it was showery up to the 9th; fine from 9th to 23rd, when R commenced, and continued until the end of the month. Prevailing wind N.W., strong on 8 days. Mean temp. 0°·6 below, and R 1·81 in. above, the average. R. B. GORE.

Auckland.—An average month, with little of note to report. R slightly above the average. Mean temp. a little below. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL, OCTOBER, 1891.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall.	7·58	XI.	Builth, Llanwrtyd Wells	11·65
,,	Margate, Birchington...	...	,,	Rhayader, Nantgwillt..	11·59
,,	Brighton, Prestonville Rd	7·17	,,	Corwen, Rhug	5·41
,,	Hailsham	6·22	,,	Carnarvon, Cocksidia ...	7·27
,,	Ryde, Thornbrough	9·03	,,	I. of Man, Douglas	6·66
,,	Alton, Ashdell.....	9·07	XII.	Stoneykirk, Ardwell Ho.	6·47
III.	Oxford, Magdalen Col...	5·63	,,	New Galloway, Glenlee	11·03
,,	Banbury, Bloxham	5·98	,,	Melrose, Abbey Gate...	2·79
,,	Northampton	4·15	XIII.	N. Esk Res. [Penicuick]	3·08
,,	Cambridge, Fulbourne..	5·43	XIV.	Ballantrae, Glendrishaig	7·30
,,	Wisbech, Bank House..	4·99	,,	Glasgow, Queen's Park.	3·63
IV.	Southend	3·88	XV.	Islay, Gruinart School..	8·25
,,	Harlow, Sheering	4·92	XVI.	Dollar.....	3·03
,,	Rendlesham Hall	3·53	,,	Balquhidder, Stronvar..	12·89
,,	Diss	3·67	,,	Coupar Angus Station..	3·92
,,	Swaffham	3·99	,,	Dunkeld, Inver Braan..	6·46
V.	Salisbury, Alderbury...	9·00	,,	Dalnaspidal H.R.S. ...	7·69
,,	Warminster	...	XVII.	Keith H.R.S.	1·44
,,	Bishop's Cannings	6·32	,,	Forres H.R.S.	·49
,,	Ashburton, Holne Vic....	5·24	XVIII.	Fearn, Lower Pitkerrie.	·80
,,	Okehampton, Oaklands.	9·30	,,	Loch Shiel, Glenaladale	13·25
,,	Lynmouth, Glenthorne.	9·12	,,	N. Uist. Loch Maddy ...	11·72
,,	Probus, Lamellyn	7·76	,,	Invergarry	5·20
,,	Launceston, S. Petherwin	...	,,	Aviemore H.R.S.	1·51
,,	Wincanton, Stowell Rec.	8·57	,,	Loch Ness, Drumnadrochit	2·04
,,	Wells, Westbury.....	...	XIX.	Lairg H.R.S.	1·29
VI.	Bristol, Clifton	8·49	,,	Scourie	4·63
,,	Ross, The Graig	6·70	,,	Watten H.R.S.	2·36
,,	Wem, Clive Vicarage ...	3·91	XX.	Dunmanway, Coolkelure	8·84
,,	Cheadle, The Heath Ho.	4·54	,,	Fermoy, Gas Works ...	5·39
,,	Worcester, Diglis Lock	5·85	,,	Darrynane Abbey.....	7·85
,,	Coventry, Coundon	6·23	,,	Tipperary, Henry Street	4·59
VII.	Ketton Hall [Stamford]	5·02	,,	Limerick, Kilcornan ...	2·92
,,	Grantham, Stainby	4·64	,,	Ennis	4·02
,,	Horncastle, Bucknall ...	3·85	,,	Miltown Malbay.....	6·19
,,	Worksop, Hodsck Priory	3·70	XXI.	Gorey, Courtown House	6·24
VIII.	Neston, Hinderton	2·85	,,	Mullingar, Belvedere...	3·93
,,	Knutsford, Heathside...	4·51	,,	Athlone, Twyford	3·91
,,	Lancaster	4·80	,,	Longford, Currygrane...	3·49
,,	Broughton-in-Furness..	6·30	XXII.	Galway, Queen's Coll...	6·34
IX.	Ripon, Mickley	4·35	,,	Crossmolina, Enniscoe..	9·44
,,	Scarborough, West Bank	3·41	,,	Collooney, Markree Obs.	5·22
,,	East Layton [Darlington]	3·88	,,	Ballinamore, Lawderdale	4·27
,,	Middleton, Mickleton..	1·98	XXIII.	Lough Sheelin, Arley ..	3·61
X.	Haltwhistle, Unthank..	2·32	,,	Warrenpoint	3·07
,,	Bamburgh	2·70	,,	Seaforde	5·49
,,	Shap, Copy Hill	...	,,	Belfast, New Barnsley..	4·38
XI.	Llanfrechfa Grange	8·93	,,	Bushmills, Dundarave...	3·89
,,	Llandovery	10·61	,,	Stewartstown	3·04
,,	Castle Malgwyn	10·92	,,	Buncrana	5·04

OCTOBER, 1891.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max Deg.	Date	Min. Deg.	Date	No. of Nights below 32° In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	4·80	+ 1·91	·64	7	20	65·9	9	29·7	31	1	3
II.		Maidstone (Hunton Court)...	6·32	+ 2·86	·83	21	23	...	...	...	...	...	...
,,		Strathfield Turgiss	7·97	+ 5·13	1·17	6	24	65·3	9	26·1	31	1	10
III.		Hitchin	6·28	+ 3·21	1·08	6	24	63·0	1	28·0	30	3	...
,,		Winslow (Addington)	6·71	+ 3·62	1·18	6	22	64·0	3, 5*a*	27·0	31	1	3
IV.		Bury St. Edmunds (Westley)	4·12	+ ·85	·53	15	19	...	...	...	...	...	...
,,		Norwich (Cossey)	3·96	+ ·12	·52	21	18	66·0	2	25·0	31	1	...
V.		Weymouth(LangtonHerring)	8·77	+ 5·23	1·23	6	22	61·0	5	32·0	31	1	...
,,		Barnstaple.....	?3·98	— 1·11	·68	18	19	67·0	3	34·0	25	0	..
,,		Bodmin (Fore Street)	10·29	+ 4·29	1·57	5	25	...	...	...	...	...	...
VI.		Stroud (Upfield)	6·92	+ 3·89	1·34	6	24	65·0	7	31·0	30	1	...
,,		ChurchStretton(Woolstaston)	6·04	+ 2·27	1·19	14	24	60·0	9	30·0	31	1	4
,,		Tenbury (Orleton)	7·02	+ 3·81	1·15	5	23	63·0	9	26·2	31	3	7
VII.		Leicester (Barkby)	4·89	+ 1·74	·94	6	25	65·0	9	23·0	30	3	6
,,		Boston	4·08	+ ·97	·60	6	20	64·0	1	28·0	31	1	...
,,		Hesley Hall [Tickhill].....	3·46	+ ·36	1·07	6	19	62·0	9	28·0	31	4	...
VIII.		Manchester(PlymouthGrove)	4·85	+ 1·48	·92	6	19	...	...	...	...	...	...
IX.		Wetherby (Ribston Hall) ...	3·38	+ ·25	·51	7	16	...	...	...	...	...	...
,,		Skipton (Arncliffe)	7·56	+ 1·53	1·34	14	22	60·0	4	30·0	29	4	...
,,		Hull (PearsonPark)	3·31	— ·34	·55	6	20	63·0	3	30·0	25	0	8
X.		Newcastle (Town Moor)	1·82	— 1·30	·26	8	16	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	15·92	+ 5·33	1·90	8	21	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	8·17	+ 3·63	1·50	18	22	...	...	...	...	...	...
,,		Haverfordwest	10·06	+ 4·91	1·52	19	25	62·2	1	29·5	30	2	...
,,		Carno (Tybrith)	6·25	+ ·73	·95	14	23	...	...	23·0	29	6	...
,,		Llandudno.....	4·06	+ ·67	·55	18	19	62·2	3, 4	34·0	31	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	9·02	+ 5·76	1·38	18	19	59·0	5	27·8	25*d*	4	...
,,		Jedburgh (Sunnyside).....	1·88	— ·77	·38	12	15	58·0	6	27·0	29	3	...
XIV.		Old Cumnock	5·41	+ 2·01	·85	5	23	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	10·73	+ 5·94	2·16	8	20	...	...	27·0	24	5	...
,,		Oban (Craigvarren)	7·85	...	1·03	13	23	59·0	3	33·2	30	0	...
,,		Mull (Quinish).....	8·37	+ 3·08	1·04	4	22	...	...	...	...	...	...
XVI.		Loch Leven Sluices.....	2·60	— ·36	·70	9	11	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	2·85	+ ·61	·60	8	12	64·2	4	29·0	31	3	...
XVII.		Braemar	4·93	+ 1·32	·89	4	18	56·0	3, 5	20·3	29	11	17
,,		Aberdeen (Cranford)	2·78	...	·48	15	18	59·0	4	29·0	28	5	...
XVIII		Strome Ferry.....	...	...	...	...	...	...	..	...	...	...	...
,,		Inverness (Culloden)	·81	— 1·44	...	...	...	61·0	3	26·0	29	4	...
XIX.		Dunrobin	·77	— 2·54	·17	16	7	59·0	4	32·0	28*d*	2	...
,,		S. Ronaldsay (Roeberry).....	2·04	— 1·69	·50	6	16	58·0	3	36·0	13	0	...
XX.	IRELAND.	Dromore Castle	7·73	+ 2·09	1·10	14	18	58·0	14*b*	33·0	28	0	...
,,		Waterford (Brook Lodge) ...	5·47	+ 1·65	1·10	15	18	61·5	4	27·0	25	2	..
,,		O'Briensbridge (Ross)	...	...	...	...	...	...	...	...	...	...	...
XXI.		Carlow (Browne's Hill)	4·71	...	1·12	5	17	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	3·59	+ ·21	1·18	13	13	62·7	4	33·0	25	0	7
XXII.		Ballinasloe	4·47	+ 1·48	1·11	13	18	58·0	3	24·0	25	9	...
,,		Clifden (Kylemore)	15·55	...	1·74	4	24	..	...	...	...	...	...
XXIII		Waringstown	4·09	+ 1·38	·94	15	16	62·0	3, 4	27·0	24	5	11
,,		Londonderry (Creggan Res.).	3·29	— ·38	·61	13	22	...	...	...	...	...	...
,,		Omagh (Edenfel)	4·61	+ 1·51	1·05	13	22	57·0	4*c*	28·0	29	4	6

a And 9. *b* And 16, 29. *c* And 5, 8. *d* And 29.

+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON OCTOBER, 1891.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail. S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—More rain fell at this station than has ever before been recorded in any month, and never before has a fall of more than one inch occurred on two consecutive days. On the 21st 1·01 in. fell, and on the 22nd 1·03 in. The floods ensuing have been altogether unprecedented. T and L on the 7th.

ADDINGTON.—Not only the wettest October, but with one exception (July, 1880,) the wettest month of the last 21 years. Our brooks ran quite full for over a fortnight, often overflowing the meadows to a great extent, and causing much inconvenience. Winds frequently very high, uprooting some big trees. T with H and R on 14th and 21st. No frost to hurt anything until the morning of the 31st, when all tender plants were cut down.

BURY ST. EDMUNDS, WESTLEY.—A mild wet month; no frost till the 30th; violent gale on the 13th; severe TS with H on the 15th. The Barometer was lowest for the whole year on the 21st—28·850 in., and highest for the whole year on the 31st—30·475 in. Wheat sowing is very backward on the heavy land.

LANGTON HERRING.—Excepting December, 1876, when the R was 9·18 in., this has been the wettest month since the observations commenced. The fall from the 5th to the 22nd was 8·12 in., which far exceeds the fall of any previous 18 consecutive days. A great gale occurred on the 13th, but not much injury was done in this neighbourhood. T and L on the 7th and L on the 21st.

BODMIN.—Rather cold, with excessive R, several gales, and H showers at times. The greatest R for October on record. Heavy R on 1st, and from 5th to 26th; thence to the end of the month fine and sunny days, with frosty nights; gales on the 26th and 28th; harvest not finished at the close.

STROUD, UPFIELD.—Corn and grass still lying out in the fields at the close. S.W. gale on the 13th; many trees blown down.

WOOLSTASTON.—A very wet month, and a great deal of grain unharvested at the end. A strong gale on the 5th, and a very violent gale on the 13th; followed by wild squally weather for three days. Mean temp. 47°·7.

ORLETON.—The wettest October recorded here in 60 years, and in that period there have been only seven months with a larger R. The temp. was about the average, but there was less frost than usual. T on the 13th and 14th: fogs on 3rd, 5th and 12th; dense fog on 8th. The first 5 days were fine, but about 0.30 a.m. on 6th, heavy R began, and continued with one interval till 8 p.m., 2·06 in. falling in the 19 hours. R fell on every day but 24th, from 5th to 26th, and there was one fall over an inch, 4 over ·75 in., 5 over ·50 in. and 8 over ·25 in., in the 24 hours.

LEICESTER, BARKBY.—Oddly enough it was a very fine, though very wet month; the R falling chiefly at night, and sunshine being above the average. Swallows left about the 22nd, and flocks of fieldfares were seen on the 16th. First frost on 28th; T on the 14th and 15th; very high winds on seven days.

MANCHESTER, PLYMOUTH GROVE.—Mean temp. 48°·5. Fine autumn weather prevailed from 3rd to 5th, 8th to 10th, on 13th, 18th, 20th, and from the 27th to the end of the month. TL and H on the 14th. Dense fog and wet mist on morning of 25th.

WALES.

HAVERFORDWEST.—This October stands third in wetness of all the months during the last 42 years. Dec. 1868 had 10·48 in., Nov. 1852, 10·37 in., and in Oct. 1891, 10·06 in. One continuous series of gales occurred from the 8th

to the 15th ; one of almost hurricane violence on the 13th, also on the 11th, and it was very stormy more or less up to the 25th, with continuous R. The wind which had been blowing constantly from S.W. and S. suddenly veered to N.N.W. on the evening of the 27th ; next morning it was due E., and the mean temp. fell 6°, this continued to the end, with clear skies and sharp white frosts.

SCOTLAND.

CARGEN.—The month up to the 23rd was unusually stormy and wet. Several gales occurred ; the last concurrently with a high spring tide, when the Nith was unusually swollen with the heavy R occasioned much damage to the embankments, and large tracts of arable land were submerged, and much stock drowned. The R from the 1st to 22nd—9·02 in., was more than twice the average for the whole month. On three days, 5th, 8th and 18th, upwards of one inch, fell on each day. Very fine weather was experienced after the 23rd. The R from August 1st to Oct. 22nd was 22·24 in., and for the previous seven months was 13·55 in. T and L on 6th, 8th, 9th, 20th and 21st, and H on 6th. Lunar rainbow seen between 10.30 and 11 p.m. on the 21st.

JEDBURGH.—The weather was wild and stormy during the first half of the month, but after that very quiet, with much sunshine. Cereal crops all got in and in better condition than was expected. High winds on 6th ; gales on 12th and 13th.

OLD CUMNOCK.—High wind at night on the 5th ; stormy on 13th, 15th and 18th ; T on 20th ; frost from 24th to 30th.

OBAN.—The month was one of almost continuous R, floods and heavy gales, till the last week, which was fair and frosty, with fogs This enabled potatoes to be saved, but some hay was still out at the close. T and L on 6th and 12th.

S. RONALDSAY, ROEBERRY.—A very fine month upon the whole ; especially the first and latter parts ; during the middle strong winds from S.W. prevailed, and a rough gale from S. on night of 13th and morning of 14th.

IRELAND.

WATERFORD, BROOK LODGE.—Mean temp. 48°·0 ; T on 6th and 15th ; gale from S. on 11th.

DUBLIN.—A month of contrasts. At the beginning some fine, warm, autumnal days were experienced, interrupted indeed by a gale and heavy R on 5th. From the 8th to the 18th was a period of violent gales and heavy rains, with brief intervals of fine weather and very unsteady temperature. Then followed a week of low barometer, but fair weather and low temperature ; from the 25th to the 31st was fine and quiet, with ground frosts and local fogs at night ; bright and warm sunshine by day, with E. winds. Mean temp. 49°·5, or 0°·2 below the average. Solar halos seen on 2nd, 7th and 22nd. High winds on 12 days, attaining the force of a gale on 8 ; fogs on 6 days ; L on 3 days ; H on 17th.

BALLINASLOE.—Strong S.W. gale on 18th. Fog on morning of 29th and all day on 30th.

KYLEMORE.—Very stormy from 4th to 6th, with 3·41 in. of R ; H on 7th ; strong S.W. gale on 8th ; R and sleet all night on the 15th and S on the mountains. Gale from S. with heavy R on 18th ; TL and heavy R on 20th, On 6 days the R exceeded 1·00 in. in 24 hours.

WARINGSTOWN.—Extraordinary range of barometer, 13th 3 p.m. 27·988 in. ; 31st, 9 a.m. 30·662 in. No R fell after the 21st, but on two occasions (25th and 30th), fog produced a measurable amount.

EDENFEL.—For the first 3 weeks gales and rains continued without the intermission of a single day, but upon the 21st an anticyclone began to spread itself over the North of Ireland, and continued accompanied by generally bright skies, or light hazy weather, calms, and occasional night frosts to the end.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

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THE TEMPERATURE AND RAINFALL OF BRAZIL.

WE recently received, through the kindness of Captain Wilson Barker, a table of the rainfall for many years at Recife (often called Pernambuco, after the name of the State of which it is the capital). This table, converted into English values, we give on page 164, together with some remarks upon it.

We also received from S. H. Morize, of the Astronomical Observatory at Rio, a copy of the pamphlet,* portions of which had already appeared in the *Revista* of the Observatory of Rio de Janeiro, in which he gives a general sketch of the climate of the country; S. Morize gave no map of the vast territory of which he treated. and for several of the places, neither their latitude nor their longitude.

By this difficulty of identifying the stations, and by the different values given in different parts of S. Morize's pamphlet, we were obliged to go back to the original authorities quoted by him, so that at last we have been led on to the compilation of the table given on pages 162 and 163. We are far from supposing that our own table is free from error. The Brazilians are not possessed of a fertile imagination in the formation of place-names, and though there may not be half-a-dozen each of S. Cruz, S. Antonio, Rio Madeira, and Victoria, there are quite enough to puzzle a stranger. Probably an Englishman, with thirteen Avons, seventeen Blackwaters, eighteen Newports, and upwards of one hundred Newtons and Newtowns, ought not to complain; but the liability to err remains. Another slight difficulty has arisen from the absence of any general survey of the country, so that the latitudes and longitudes of identical places are given differently by different writers, and by the same writer in different publications, and sometimes in the same article or book—*e.g.*, in the table on p. 47 S. Morize gives for the first station 1° 27′ S. by mistake for 2° 31′ S., and his last stations as 31° 16′ and 32° 0′, whereas on earlier pages he had given the former as 31° 45′, and the latter as 32° 6′. We have done our best to detect all such errors, and hope that few stations are even 10′ (say 10 miles) from their true position.

* *Esboço de uma Climatologia do Brazil*, por H. Morize. Lombaerts and Co., Rio de Janeiro. 8vo, 47 pages. 1891.

Mean Temperature and Mean Rainfall in Brazil.

NOTE.—The stations are grouped in order of increasing latitude in each State, and the States are taken in the same order, *i.e.*, the most northerly first, and the most southerly last.

State.	Town.	Lat. S.	Lon. W.	Alti-tude	Mean Temp.	Mean Rain.	No. of years	Authority.
		° ′	° ′	ft.	°	in.		
Pará	Belem	1 27	48 37	...	81·3	?121·6	2	M 47
,, ...	,, ...	...	...	...	...	70·4	4	D
,, ...	S. Antonio	8 30	62 40	...	78·8	91·3	1	M 46
Maranhao ...	S. Luiz	2 31	44 2	141	81·3	96·7	2	M 47
,, ...	,, ...	...	...	...	...	280·0	1	Humboldt
,, ...	,, ...	...	...	...		108·1	...	M 46
Rio Negro ...	Manaos	3 8	59 58	131	79·8	87·8	5	M 47
,, ...	,, ...	...	...	...	...	92·1	4	M 46
,, ...	,, ...	...	...	...	...	55·1	1	D
Ceara	Fortaleza	3 44	38 31	...	79·9	59·1	28	M 47
,, ..	,, ...	...	...	...	...	58·6	28	M 46
,, ...	,, ...	...	...	...	...	58·7	28	D
,, ...	,, ...	...	...	...	...	60·6	..	Raulin
,,	Quixeramobim (or Campo Major)	5 16	39 25	...	84·7	...	...	M 47
,, ...	Ico	6 13	39 0	...	79·9	...	...	M 19
,, ...	Crato	6 50	39 45	...	82·3	...	...	M 19
Piauhy	Theresina	5 6	41 50	...	80·2	...	...	M 17
,,	Valle do Alto Paranhyba ...	?6°	43½°	...	...	38·0	1	D
,, ...	Amarante	6 13	42 55	...	79·2	31·1	1	M 47
,, ...	,, ...	...	...	...	80·8	...	...	M 17
Pernambuco.	Recife	8 4	34 51	...	79·2	117·0	8	D
,, ...	,, ...	...	...	...	78·3	116·1	3	Beringer
,, ...	,, ...	...	...	...	...	91·2	13	W. Barker
,, ...	Victoria.....	8 9	35 27	528	77·2	41·4	7	D
,, ...	Jagueira	8 10	35 57	...	...	73·2	3	McGrath
,, ..	Cabo	8 15	35 3	...	...	46·4	1	Zeits. 24
,, ...	Colonia Isabel....	8 45	35 42	751	74·7	40·8	7	D
,,	S. Anna do Sobradinho ..	9 26	40 47	1053	80·2	14·6	3	D
Bahia	S. Bento das Lages	12 37	38 40	98	76·6	85·8	5	D
,, ...	Bahia.....	12 58	38 32	210	78·8	85·1	5	M 47
,, ...	,, ...	...	...	...	...	94·3	5	D
,, ...	,, ...	...	...	...	...	79·3	2	D
Matto Grosso	Cuyabá	15 48	56 15	673	79·3	45·9	3	M 47

Mean Temperature and Mean Rainfall in Brazil—(continued.)

State.	Town.	Lat. S.	Lon: W.	Altitude	Mean Temp.	Mean Rain.	No. of years	Authority.
		° ′	° ′	ft.	°	in.		
Minas Geraes	Cattas Altas.....	18 50	43 10	3400	66·3	..	2	Henwood
,, ...	Uberaba	19 40	48 5	2461	...	61·5	3	D
,, ...	,, ...	...	...	...	69·8	...	...	M 35
,, ...	Lagoa Santa.....	19 40	42 45	2740	68·9	...	...	M 35
,,	Congonhas de Sabará.....	19 47	44 19	2280	...	64·5	25	D
,, ...	Gongo Soco	19 59	43 30	3360	67·6	115·7	2	D
,, ...	,, ...	...	...	...	...	...	3	Henwood
,, ..	Itabira	20 15	43 55	2733	66·5	51·3	1	D
,, ...	Queluz	20 40	44 17	3222	67·8	57·5	3	M 47
,, ...	,, ...	...	...	...	..	57·2	2	D
,, ...	Barbacena.....	21 10	44 0	3281	64·2	52·8	1	M 47
,, ..	Ribeirão Preto...	21 10	43 45	1706	68·0	23·6	1	M 47
,, ...	Cascata	21 53	46 15	4167	64·4	59·1	1	M 37
Sao Paulo ...	Casa Branca.....	21 47	47 40	2428	74·3	39·4	1	M 47
,, ...	Sao Paulo	23 33	46 36	2395	62·2?	59·1	5	M 47
,, ...	,, ...	...	...	...	66·9	...	10	M 37
,, ...	,, ...	...	...	..	...	59·2	4	D
,, ..	,, ...	...	...	...	64·4	55·0	1	Zeit. 23
,, ...	Tatuhy	23 34	47 40	...	66·2	54·2	2	M 47
,, ..	,, ...	...	...	...	...	54·8	1	M 46
,,	Alto da Serra do Cubatao ..	23 40	46 20	2625	...	140·8	15	D
,, ..	,, ...	...	...	...	...	142·2	15	Symons
,,	Raiz de Serra do Cubatao...	23 45	46 30	...	...	142·4	15	M 46
,, ...	Santos	23 56	46 17	95	...	98·6	15	D
,, ...	Curytiba	25 26	49 13	2979	64·2	...	2	M 47
,, ...	,, ...	...	...	...	67·8	..	...	M 43
,, ...	Joinville	...	...	...	62·4	58·9	6	Zeit. 26
,, ...	,, ...	26 17	53 48	...	69·1	...	...	M 43
,, ...	,, ...	...	...	...	...	89·8?	2	D
RiodeJaneiro	Nova Friburgo...	22 19	42 25	2874	63·0	51·7	4	M 47
,, ...	Rio..... ..	22 54	43 8	217	74·3	44·3	36	M 47
,, ...	,, ...	...	...	...	...	38·4	29	D
,, ...	,, ...	...	...	...	...	42·9	...	Raulin
,, ...	Santa Cruz	22 56	43 10	85	72·4	66·9	2	M 47
S. Catharina.	Blumenau.....	26 55	48 55	...	70·5	60·7	6	M 47
Sao Pedro do Sul	S. Ant. da Palmeira	27 45	53 24	1896	64·4	...	1	M 47
,, ...	Passo Fundo.....	28 28	52 37	2060	62·8	...	1	M 47
,, ...	Taquara.....	29 40	50 47	...	65·7	...	...	M 45
,, ...	Santa Cruz	29 45	52 40	...	66·6	...	...	
,, ...	Pelotas	31 46	52 27	2871	63·0	42·0	1	M 47
,, ...	,, ...	...	...	...	...	38·2	6	Zeit. 19
,, ...	,, ...	...	...	...	...	52·4	2	D
,,	Rio Grande do Sul	32 6	52 11	53	65·8	35·9	9	M 47
,, ...	,, ...	...	...	...	...	34·3	9	D

MONTHLY RAINFALL AT RECIFE, PERNAMBUCO, 1842-90.

(According to the authorities stated at the foot of the Table.)

	January.	February.	March.	April.	May.	June.	July.	August.	September	October.	November.	December.	Total.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1842	5·98	1·97	8·11	24·84	15·95	24·86	15·85	3·10	1·02	1·11	·28	1·29	104·36
								3·41	1·11	1·36	·50	1·85	
1843	1·11												
	1·03	1·22	14·17										
1861	21·20	2·15	8·49	15·46	18·09	16·00	8·42	8·45	2·17	·58	·59	1·32	102·92
1862	5·26	2·99	3·18										
1875	2·22	11·38	13·23	25·64	14·43	8·92	12·06	13·39	6·92	4·03	1·63	1·17	115·02
1876			17·89	12·96	16·72	29·39	25·56	15·02	8·66	1·43	·37	3·68	
			19·26	15·87	18·43	29·31	25·56	15·01	8·66	1·43	·37	3·68	
1877	3·72	1·77	4·60										
	3·72	1·77	4·60	1·20	18·19	4·05	22·00	7·39	4·88	·15	1·26	·26	69·47
1878	2·09	1·74	2·47	8·08	21·39	51·75	56·68	15·47	8·12	2·42	·14	2·87	173·12
1879	10·94	2·98	1·19	9·37	15·06	22·14	16·73	2·22	6·91	·23	·00	5·45	93·22
1880	3·91	13·09	26·61	15·87	17·18	33·18	21·45	37·62	6·45	·39	1·85	1·13	178·73
1881	·51	8·96	1·64	16·43	12·01	24·14	54·53	11·58	14·88	1·54	·23	·36	146·81
1882	1·22	4·30	1·23	11·40	12·37	20·77	23·17	7·91	1·50	·49	·67	3·63	88·66
1883	10·56	10·56	3·67	14·04	9·95	5·56	3·31	6·03	5·65	·18	3·82	·56	73·89
1884	1·03	·46	12·19	13·58	5·47	11·93	7·21	3·11	1·58	1·02	1·49	·26	59·33
1885	·65	4·43	·22	32·60	24·07	6·23	2·89	4·49	1·37	1·83	·45	·32	79·55
1886	4·61	2·09	4·51	15·40	9·98	16·38	9·19	9·05	1·58	·34	·79	·80	74·72
1887	·89	·08	4·43	14·75	8·50	9·74	9·95	5·27	1·10	2·57	·02	2·67	59·97
1888	1·57	1·24	6·39	6·58	8·07	11·58	8·77	3·17	·61	·70	1·73	·32	50·73
1889	2·70	2·31	3·43	2·62	6·67	7·36	5·55	2·22	1·11	·23	·50	2·23	36·93
1890	2·89	1·06	8·18	5·29	4·56	7·56	8·76	7·51	1·54	·47			

1842.—Observer unknown. Authority : Table from Capt. Wilson Barker.
1842 (August) to 1843 (January).—Dr. J. J. de Moraes Sarmento ; 10 ft. above sea. Béringer.
1843 (January to March).—Dr. J. Loudon, in Boa-Vista. Béringer.
1861 (January) to 1862 (March).—Observed at the Arsenal. Béringer.
1875 (January to December).—Observed at Apipucos by the Recife Drainage Company. Béringer.
1876 (March) to 1877 (June).—Observed at the Model School at Recife.* ; R.G. 19 ft. above ground. Béringer.
1876 (March) to 1890 (October).—Unknown.—Table from Capt. Wilson Barker.
From July, 1877, to March, 1878, these values are identical with those furnished by Captain Wilson Barker.

Total Rainfall in various years extracted from "Revista do Observatorio do Rio de Janeiro."

State and Town.	Lat. S.		Lon. W.		Altitude.	Rainfall in						
						1883	1884	1885	1886	1887	1888	1889
Minas Geraes—	°	′	°	′	ft.	in.	in.	in.	in.	in.	in.	in.
Barbacena	21	10	44	0	...	...	...	...	...	...	...	52·82
S. Paulo—												
Sao Paulo	23	33	46	36	...	...	...	...	...	58·93	49·88	...
Tatuhy	23	34	47	40	...	...	...	...	...	...	54·85	...
Ponta Grossa	25	6	49	50	3107	...	...	...	...	68·33	...	...
Curytiba	25	25	49	25	2933	...	...	...	52·50	54·31	...	...
Morietes	25	28	48	35	46	...	...	...	73·62	74·66	...	...
Paranaguá	25	31	48	30	26	...	...	...	...	82·48	...	...
Palmas	26	29	...		3789	...	...	...	...	61·83	...	...
Rio de Janeiro—												
Nova Friburgo	22	19	42	25	...	48·29	63·99	46·85	66·18	...	...	...
Rio de Janeiro Ct.	22	54	43	8	..	55·42	50·20	33·90	...	...	...	...
,, ,, Terrace	22	54	43	8	...	49·49	46·77	30·69	38·03	39·27	55·12	28·48
S. Pedro do Sul—												
Santa Cruz	29	45	52	40	...	...	...	...	...	66·22	67·24	37·76
Rio Grande	32	6	52	11	...	1882–4. 29·21		...	...	...	...	...

In Vol. IV. of the *Revista*, pp. 103-105, we find a summary for 1888 of the observations at twenty-one stations in the State of Rio Grande do Sul. Many of these stations were started only in the course of that year, but the yearly values seem to be perfect for the undermentioned :—

Station.	Altitude. ft.	Rain in 1888. in.
S. Borja	—	35·34
Itaqui	—	50·39
Uruguayana	341	52·69
Livramento	—	43·97
Santa Maria	479	21·65
Cacimbinhas	—	55·75
Rio Grande	53	28·08
Barra	26	33·10

As regards the accuracy of the returns, we can accept no responsibility whatever. The majority of the temperatures seem to agree better than we should have anticipated, because there are so few values based on records of adequate length, and there is hardly an iota of information as to how the thermometers have been mounted. So with the rain returns, we have no information as to the position of a single gauge, and very little as to their construction, while many of the averages (!) are noted as being merely the totals of a single year.

It may be said—Why spend time and space over such materials? The answer is obvious. The climate of the enormous* territory of Brazil is an important subject, and we have endeavoured to collect all that we could, with the double object of showing what has been done and what remains to be done. Where we could obtain *demonstration* that printed figures were misprints we have refrained from quoting them, but in all other cases we leave our readers in possession of the English equivalents of the figures as published, and we leave the responsibility with those who first issued them—*e.g.*, we believe that the mean rainfall at S. Luiz do Maranhao is about 100 inches, and we quote the two different values of 2455 mm. (96·7 in.) and 2745 mm. (108·1 in.), given by S. Morize; but we have the high authority of Humboldt for a record for one year of 280·0 in., and therefore we quote it.

Having thus stated our standpoint, no further explanation of the table is needed, except as regards the last column :—

M = Morize—*i.e.*, the pamphlet, of which the title has just been given, and the figures following the M are those of the pages on which the values are given—*e.g.*, M 47 = the 47th page of S. Morize's book.

D = Draenert.—Dr. Draenert has done much towards making Europeans acquainted with the climate of his country, and has contributed many valuable papers to the *Zeitschrift*, notably one on "Die Vertheilung der Regenmengen in Brasilien," in the volume for 1886.

Henwood = a paper "On Subterranean Temperature," in the *Trans. Roy. Geol. Soc. of Cornwall*, vol. viii., p. 723.

Béringer = "Recherches sur le climat et la mortalité de la ville de Recife ou Pernambuco."—*Ann. Soc. Met. de France*, xxvi., 1878, p. 28.

Zeit. = The *Zeitschrift*, and the number indicates the volume.

Our original idea was to give maps showing the observations plotted, and by shading or by curves; but on making such maps, it at once becomes evident (what might have been inferred independently) that the grouping of the stations closely resembles that of the population of European origin. Along the coast, in the cooler Southern states, and in the mining district of Minas Geraes, the records are tolerably plentiful; but in the vast interior there is little except the records of two or three explorers. Some meteorologists, with not a tithe of the data we possess, have run isobars, isotherms, and isohyetal shading all over the country. We do not impugn the accuracy of their imagination, but we prefer not to follow in their steps until better information is obtainable.

We do not understand why S. Morize, who seems at one time to have been one of S. Cruls' assistants in editing the *Revista*, never mentions that work, and does not quote half the returns which are

* About twice as large as India, and 16 times as large as France.

given in it. We know that it contains a good many misprints, and that Brazilian meteorological records are remarkable for their fragmentary character; but without claiming to have extracted every record possible, we have found in the *Revista* the values given in the table on page 165, and we do not understand why so many of them have been ignored by S. Morize. Doubtless a tropical climate is responsible for many things, but it does seem to us rather a pity that before embarking on his great enterprise of a Climatology of the World, Senor Cruls did not first try to give us a Climatology of Brazil. Neither he nor any one can yet give us particulars as to that of Solimoes, or of Goya, or of Matto Grosso, but if a private individual in the other hemisphere can in a few weeks get together such a series of data as are shown in these tables, how infinitely better could it be done by the Director of the National Observatory of Rio de Janeiro?

THE MARTINIQUE CYCLONE OF AUGUST 18TH, 1891.

THE *Monthly Weather Review* for August, 1891, issued by the U. S. Weather Bureau, contains a fac-simile of the trace of a Richard Barograph such as we have never before seen; we therefore reproduce it for the inspection of our readers, and we quote from the *Review* two paragraphs illustrative of the damage produced by this great and sudden diminution of pressure. In our last number we quoted the rise of the barometer, 0·28 in. in an hour at Fort William, as exceptional, and we are not aware of anything more rapid being on record in the British Isles; but it is not a third of the rate of fall at Martinique, which was *nearly an inch in the hour* between 7.10 to 8.10 p.m. (*See frontispiece.*)

The general track of the storm, as worked out in the *Review*, was unusual, for though it was first noticed a little N. of Barbados, and then passed W.N.Wly. towards St. Domingo, it did not then curve round and take an E. or N.E. path, but continued even more Wly. than before, and passed the extremity of Florida, going W. into the Gulf of Mexico about a week after passing Martinique.

"The night of the 18th one of the most disastrous of the type of storms known as West India cyclones devastated the Island of Martinique, in the Windward West Indies. At Martinique the storm continued four hours, from 6 to 10 p.m., and the centre passed that place between 7 and 8 p.m., apparently travelling in a west-north-west direction at a speed of about 11 miles per hour. During the day a fresh north-north-east breeze had prevailed at Martinique, with rapidly falling barometer and wind increasing in force. The storm struck the east side of the island about 6 p.m., and in its passage over the island the destruction was less complete on the elevated plains. The wind veered from E.N.E. to S.S.E., and was most destructive from the latter point. Incessant lightning, unaccom-

panied by thunder, continued throughout the storm, and at its conclusion two distinct shocks of earthquake occurred at intervals of about five seconds. It is stated that in the vicinity of Caraval Rock at 10 a.m. two immense waves passed from the direction of Saint Lucia, the sea in the vicinity being quite calm. Another notable feature was the deafness experienced by every person in Martinique during the passage of the storm. The loss of life at Martinique is reported at 700; many persons were injured; property was destroyed to the valne of $10,000,000 (£2,000,000); and all vessels about the island, some 50 sail of all classes, were wrecked.

"Mr. Léon Sully, in a report accompanying the diagram, states that from 8.10 to 8.40 p.m. this barometer vibrated excessively, but a good aneroid barometer recorded every difference of pressure, and the passage of the center over Saint Pierre was clearly marked at 28·98 in. (736). The other minima (due to rapid oscillations varying in time from 2 to 3 seconds to 2 to 3 minutes) indicated clearly the passage of secondary whirls, rendered evident by the terrific noise of tiles and broken roofs; this fact was corroborated on the following day by the appearance of certain broken trees which could not have been bent in the way they were except by a strong gyratory movement. Moreover, in certain places in the country there were long lanes or paths where the destruction was greater than elsewhere."

Respecting these paragraphs we may offer one or two remarks.

The statement that the lightning was "unaccompanied by thunder" should probably be read along with the one stating that "another notable feature was the deafness experienced by every person in Martinique."

The loss of property is stated in *La Nature* to be estimated at 150 million francs; this would be £6,000,000. Let us hope that the figures in the *Review* are nearer the truth. Two millions is a sufficiently serious loss for Martinique.

We hope that some one with leisure will take up the investigation of this storm, and ascertain why it continued to travel westwards.

ROYAL METEOROLOGICAL SOCIETY.

THE first meeting of the present session was held on Wednesday evening, the 18th November, at the Institution of Civil Engineers, Mr. Baldwin Latham, M.Inst.C.E., President, in the chair.

Eleven new Fellows were elected.

Mr. R. H. Scott, F.R.S., gave an account of the proceedings of the International Meteorological Conference, which was held at Munich from August 26th to September 2nd. (*Deferred for want of space*).

The following papers were also read :—

1. "Account of an Electric Self-Recording Rain Gauge," by Mr. W. J. E. Binnie, B.A. This is a veryingenious instrument, in which

each drop of rain collected by a small funnel causes an electric current to be sent through apparatus, whereby the recording pen makes a trace on the cylinder. The gauge is said to be one of the most sensitive and also of the cheapest yet produced.

2. "On Wet and Dry Bulb Formulæ," by Professor J. D. Everett, F.R.S. This is a criticism of the methods investigated some years ago by Prof. August and Dr. Apjohn for determining, by calculation, the maximum vapour tension for the dew point from the temperatures of the dry and wet bulb. Professor Everett also criticises the values adopted by Regnault, and says that in presence of the uncertainty as to a rational formula, he thinks that Mr. Glaisher did wisely in constructing his table of factors, which give the dew point approximately by the most direct calculation which is admissible. The inherent difficulties of hygrometric observation and deduction are great, and have not yet been fully overcome.

3. "Results of Meteorological Observations made at Akassa Niger Territories, May, 1889, to December, 1890," by Mr. F. Russell, F.R.G.S. This is a continuation of a former communication respecting the same place. After detailing the results of the various observations, the author says that this period was very unhealthy, and the year 1890 especially so. The weather was exceptionally dry, with small-pox and phthisis amongst the native population. The west coast reports generally were also unfavourable in reference to the condition of resident Europeans, and at the principal ports quarantine regulations were put in force consequent upon an outbreak of yellow fever in places situated to the south-west. At Bonny from November to February ten deaths occurred out of a population of sixteen Europeans.

THE UNITED STATES WEATHER BUREAU.

WE have already recorded the magnificent appropriation which Congress placed at the disposal of its Meteorological Service, and although Prof. Harrington has not yet been five months at the head of the organization, we have already received from him a report of work done in the first three months, which is certainly more than any other meteorological office ever accomplished in a year.

When a faculty for administration, vigorous health, ample funds, and freedom from meddlesome interference fall to the lot of one man, the results are always good; and, as far as we can at present judge, the U.S. Weather Bureau is going to set an example for others to follow.

The report before us* extends to 26 pages, and we can state only a few facts.

Originally the forecasts were made in Washington for the whole

* Special Report of the Chief of the Weather Bureau to the Secretary of Agriculture. 8vo. Washington, 1891.

country. This branch has been largely de-centralized, and some of the best observers (and we think some of the former forecasters) have been nominated as "Local Forecast Officials" at important centres throughout the country.

Local weather maps were issued at several of the principal stations, and they were in some cases badly prepared. The attention of the issuing officers has been called to this, and they have been instructed to send to Washington daily *the worst copy produced.*

Many stations, chiefly at military posts, have been discontinued, and fresh ones started at the nearest city or town. This is the only fact that we do not like; it may have been unavoidable, but we should have preferred the old stations running on for 6 or 18 months concurrently with the new ones.

As no extra grant had been made to defray the cost of storm signals on the coasts and Great Lakes, no important development has taken place in that branch.

The special service for the cotton-growing industry has been developed, and an analogous one organized for the benefit of sugar growers.

Great attention has been given to the organizing of "State" weather services, the number having been raised from 28 to 39; and volunteer observers have been enlisted to the total number of about 200, of whom about half have received instruments from the Government, and the others have purchased theirs, or had them presented. These volunteer stations seem to be placed to a considerable extent under the supervision of the chief officer of the Bureau in each State, so that in case of a broken instrument or other accident the damage can be made good without sending across the continent to Washington; another case of de-centralization which is decidedly good.

What is called the "Records Division," but which in this country would perhaps be called the Head-Office-Staff, has been reduced, partly, no doubt, owing to the de-centralization which we have already mentioned. There is certainly no present indication of any falling off in the output of work; in fact, in some respects even America seems not to be big enough for this vigorous Bureau, as it has lately been working up the climate of the Riviera. Prof. Harrington tells us (and we do not for a moment doubt it) that there are better climates in the United States, and he half hints that his countrymen should try them. While the Americans remain as rich as they now are, we think that it will take something more than thermometers and rain-gauges to prevent their coming to Europe, but we are by no means sure that Prof. Harrington may not succeed in establishing a "return current" of Europeans to winter in the warmer Southern States.

The river and flood service seems to continue much as formerly. It is true that English floods rarely do much damage, but it is humiliating to have to state that though in nearly every country in

Europe, in Australia, and in the United States the *régime* of the rivers is carefully studied and recorded, there is nothing of the kind in England. We have many "Conservancy Boards" in this country, but we never received from any one of them more than the smallest fragment of hydrological information.

We do not understand the opening statement with reference to instruments: "The instrument room is charged with the issue of instruments and accessories, except rain-gauges, to all the regular and voluntary observers of the Weather Bureau." We know that years ago some very extraordinary patterns of rain-gauges were used in the States, but why in 1891 the rain-gauges are exempted from the verification and issue of the experts in the instrument room at Washington we cannot imagine.

With respect to the Library, we are told that besides the routine work, the Librarian is keeping up to date the General Bibliography of Meteorology begun in 1884; that it now comprises about 60,000 titles; and that it is anticipated that it will be largely increased during the present fiscal year, and that an appropriation may be made for its publication.

This subject is further dealt with in a short note (upon Prof. Harrington's visit to Europe for the Munich Conference), in which he states that, "The International Bibliography of Meteorology, as begun by General Hazen, and published in part by General Greely, seems to have attracted the greatest interest among European students, as it attempts to satisfy a want that has long been recognized. We were so fortunate as to enjoy a prolonged interview with Dr. Hellman at Berlin, and Mr. Symons in London, the two Europeans who have probably done the most work in connection with the Bibliography of Meteorology. Evidently the general sentiment in Europe is to the effect that the work thus far done by the Signal Office is too important to be left unfinished, and that the interests of meteorology and of climatology alike demand that the Weather Bureau shall publish the complete work in proper style after obtaining from European co-laborers all possible corrections to the manuscript that has already been milleographed."

It is needless to say more respecting this subject than that we are delighted to see that Prof. Harrington has exactly grasped the situation, and that we do not believe that there is a meteorologist living in any quarter of the globe who will not be ready to do his share, be it large or small, to make this work a credit, even to the greatest Weather Bureau which ever existed.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MAY, 1891.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	80·2	13	30·7	17	60·5	43·0	42·1	80	122·7	28·0	2·72	19	6·3
Malta	76·6	5	50·4	20	70·5	57·1	54·8	77	134·4	42·9	·26	4	4·3
Cape of Good Hope	72·9	11*a*	42·0	24	65·0	52·3	...	...	...	...	7·73	13	5·1
Mauritius	79·4	8*b*	57·0	31	77·1	67·2	63·9	77	126·5	48·4	1·76	21	5·2
Calcutta	99·3	3	71·2	11	93·8	77·6	77·2	77	157·8	66·5	4·18	8	4·6
Bombay	91·4	26*c*	77·0	6	89·9	80·1	75·4	74	141·0	66·1	·00	0	3·3
Ceylon, Colombo	91·0	6	73·1	20	87·6	76·8	73·2	78	149·0	70·0	17·65	25	7·5
Melbourne	72·7	5	34·4	20	63·6	45·1	46·1	75	125·2	27·5	2·25	7	4·7
Adelaide	78·1	5	37·7	10	68·9	49·7	44·0	57	139·1	25·9	·20	5	3·7
Tasmania, Hobart	71·5	5	36·3	22	59·5	44·5	46·1	79	121·0	31·7	2·03	9	7·4
Wellington	65·0	13	37·0	22	58·2	45·6	47·5	85	120·0	28·0	2·08	17	4·2
Auckland	66·0	11	43·0	28	61·9	49·5	45·5	69	125·0	35·0	3·41	15	4·8
Jamaica, Kingston	...	...	...	...	...	...	...	...	...	...	...	...	...
Trinidad	95·0	23	67·0	2, 18	90·8	70·0	70·5	73	156·5	57·0	2·54	11	...
Toronto	78·0	9	30·2	5	62·1	41·3	38·3	59	...	22·8	·53	12	6·1
New Brunswick, Fredericton	77·7	29	29·0	6	62·8	38·1	40·7	66	...	...	2·20	22	5·7
Manitoba, Winnipeg	93·6	7	14·8	3	64·9	34·7	37·1	59	...	...	·94	14	4·5
British Columbia, Esquimalt	69·1	20	36·5	8	61·5	44·8	48·0	85	...	...	·79	13	4·0

a And 31. *b* And 10. *c* And 28, 29, and 31.

REMARKS.

MALTA.—Mean temp. 62°·2; mean hourly velocity of wind 10·4 miles. Sea temp. rose from 63°·0 to 67°·5. TS on 6th, with a little H. J. SCOLES.

Mauritius.—Mean temp. of air 0°·8 below; dew point 0°·2 below; and R 2·43 in. below, their respective averages. Mean hourly velocity of wind 8·9 miles, or 1·1 below average; extremes, 24·0 on 19th and 0·0 on 25th; prevailing direction S.E. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on 10 days. P. S. WARREN.

Melbourne.—Mean temp. of air 0°·6 above the average; mean temp. of dew point same as the average; humidity 3 below, cloud 1·9 below, and R ·15 in. above, their respective averages. Prevailing direction of wind N. and N.E.; strong on 6 days. Heavy dews on 20 days. Hoarfrost on 3 days. Fog on the 12th. L on 2 days. R. L. J. ELLERY, F.R.S.

Adelaide.—A very dry month, the rainfall being 2·86 in. below the average of 34 years, and the smallest on record for May. Mean temp. 1°·6 above the average, and mean daily range (19°·2) the greatest observed in May. Very dry all over the colony. C. TODD, F.R.S.

Wellington.—Generally showery, with intervals of fine weather. Prevailing winds N.W., strong on 5 days. Some pleasant weather towards the end of the month. Rainfall less than half the average. Mean temp. 0°·1 below the average. R. B. GORE.

Auckland.—A cold, showery month, but no unusual features in the weather. Rainfall ·75 in., and mean temp. 1°·5 under the average. T. F. CHEESEMAN

SUPPLEMENTARY TABLE OF RAINFALL, NOVEMBER, 1891.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall.	3·72	XI.	Builth, Llanwrtyd Wells	4·78
,,	Margate, Birchington...	...	,,	Rhayader, Nantgwillt..	6·50
,,	Brighton, Prestonville Rd	3·53	,,	Corwen, Rhug	3·88
,,	Hailsham	3·47	,,	Carnarvon, Cocksidia ...	5·62
,,	Ryde, Thornbrough	4·41	,,	I. of Man, Douglas	5·79
,,	Alton, Ashdell.....	4·05	XII.	Stoneykirk, Ardwell Ho.	5·11
III.	Oxford, Magdalen Col...	2·18	,,	New Galloway, Glenlee	6·99
,,	Banbury, Bloxham	2·53	,,	Melrose, Abbey Gate ...	2·66
,,	Northampton	2·30	XIII.	N. Esk Res. [Penicuick]	2·65
,,	Cambridge, Fulbourne..	2·21	XIV.	Ballantrae, Glendrishaig	5·19
,,	Wisbech, Bank House..	2·31	,,	Glasgow, Queen's Park.	3·61
IV.	Southend	·96	XV.	Islay, Gruinart School..	5·69
,,	Harlow, Sheering	1·90	XVI.	Dollar.....	3·13
,,	Rendlesham Hall	1·60	,,	Balquhidder, Stronvar..	7·51
,,	Diss	1·76	,,	Coupar Angus Station..	4·13
,,	Swaffham	1·74	,,	Dunkeld, Inver Braan..	4·58
V.	Salisbury, Alderbury...	3·94	,,	Dalnaspidal H.R.S. ...	5·99
,,	Warminster	...	XVII.	Keith H.R.S.	3·10
,,	Bishop's Cannings	2·57	,,	Forres H.R.S.	1·16
,,	Ashburton, Holne Vic....	9·08	XVIII.	Fearn, Lower Pitkerrie.	1·83
,,	Okehampton, Oaklands.	4·53	,,	Loch Shiel, Glenaladale	8·95
,,	Lynmouth, Glenthorne.	4·74	,,	N. Uist. Loch Maddy ...	7·71
,,	Probus, Lamellyn	4·96	,,	Invergarry	4·55
,,	Launceston, S. Petherwin	...	,,	Aviemore H.R.S.	1·09
,,	Wincanton, Stowell Rec.	3·84	,,	Loch Ness, Drumnadrochit	1·60
,,	Wells, Westbury.....	...	XIX.	Lairg H.R.S.	4·70
VI.	Bristol, Clifton	2·49	,,	Scourie	...
,,	Ross, The Graig	3·02	,,	Watten H.R.S.	2·28
,,	Wem, Clive Vicarage ...	2·07	XX.	Dunmanway, Coolkelure	5·62
,,	Cheadle, The Heath Ho.	3·07	,,	Fermoy, Gas Works ...	3·57
,,	Worcester, Diglis Lock	2·07	,,	Darrynane Abbey.....	4·57
,,	Coventry, Coundon	2·68	,,	Tipperary, Henry Street	3·55
VII.	Ketton Hall [Stamford]	3·14	,,	Limerick, Kilcornan ...	2·26
,,	Grantham, Stainby	3·74	,,	Ennis.....	2·73
,,	Horncastle, Bucknall ...	2·78	,,	Miltown Malbay.....	3·59
,,	Worksop, Hodsck Priory	2·48	XXI.	Gorey, Courtown House	5·08
VIII.	Neston, Hinderton	3·00	,,	Mullingar, Belvedere ...	2·69
,,	Knutsford, Heathside...	2·43	,,	Athlone, Twyford	2·47
,,	Lancaster	4·25	,,	Longford, Currygrane...	2·37
,,	Broughton-in-Furness..	8·06	XXII.	Galway, Queen's Coll...	2·19
IX.	Ripon, Mickley	3·71	,,	Crossmolina, Enniscoe..	3·80
,,	Scarborough, West Bank	2·73	,,	Collooney, Markree Obs.	3·17
,,	East Layton [Darlington]	3·08	,,	Ballinamore, Lawderdale	2·74
,,	Middleton, Mickleton..	3·21	XXIII.	Lough Sheelin, Arley ..	2·44
X.	Haltwhistle, Unthank..	2·19	,,	Warrenpoint	4·16
,,	Bamburgh.....	2·76	,,	Seaforde	4·44
,,	Shap, Copy Hill	...	,,	Belfast, New Barnsley..	3·27
XI.	Llanfrechfa Grange	3·92	,,	Bushmills, Dundarave...	3·88
,,	Llandovery	4·01	,,	Stewartstown	2·67
,,	Castle Malgwyn	5·66	,,	Buncrana	3·12

NOVEMBER, 1891.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max Deg.	Date	Min. Deg.	Dat	No. of Nights below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·08	— ·58	·40	10	18	57·2	1	29·0	28	1	14
II.		Maidstone (Hunton Court)...	1·78	— 1·15	·61	10	17	...	...	...	...	...	...
,,		Strathfield Turgiss	2·49	— ·23	·82	10	18	56·1	19	27·8	28	6	20
III.		Hitchin	2·09	— ·59	·55	13	20	56·0	19	27·0	24	9	...
,,		Winslow (Addington)	1·99	— ·94	·42	10	18	58·0	19	26·0	8, 30	7	15
IV.		Bury St. Edmunds (Westley)	1·88	— ·67	·38	10	18	...	...	...	...	...	...
,,		Norwich (Cossey)	1·78	— ·79	·30	24	13	...	...	...	...	...	...
V.		Weymouth(LangtonHerring)	3·92	+ ·26	1·04	10	16	55·0	18*c*	29·0	24	3	..
,,		Barnstaple.....	3·39	— 1·22	·59	26	14	58·0	19	28·0	24	...	..
,,		Bodmin (Fore Street)	6·54	+ 1·07	1·51	10	21	...	...	...	...	...	...
VI.		Stroud (Upfield)	2·54	— ·79	·66	10	18	54·0	2	28·0	24	7	...
,,		ChurchStretton(Woolstaston)	2·74	— ·78	·52	10	19	54·5	18	30·0	23	7	15
,,		Tenbury (Orleton)	2·78	— ·36	·79	10	15	56·9	19	23·0	25*h*	14	17
VII.		Leicester (Barkby)	2·62	+ ·33	·58	15	18	56·0	18	22·0	7	12	21
,,		Boston	2·25	+ ·05	·65	28	11	54·0	4	25·0	30	9	...
,,		Hesley Hall [Tickhill].....	2·33	+ ·31	·42	10	20	55·0	18	26·0	28*e*	9	...
VIII.		Manchester(PlymouthGrove)	2·33	— ·67	·35	11	17	54·0	2	28·0	29	8	12
IX.		Wetherby (Ribston Hall) ...	2·36	+ ·29	·75	11	13	...	...	...	...	...	..
,,		Skipton (Arncliffe)	6·02	— ·73	·77	8	18	57·0	24	23·0	27	7	...
,,		Hull (PearsonPark)	2·95	+ ·94	·57	28	23	55·0	19	27·0	28*e*	9	19
X.		Newcastle (Town Moor)	2·22	— ·18	·60	10	15	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	13·89	— ·90	2·01	10	21	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	4·04	— ·87	·78	28	15	...	...	...	...	...	...
,,		Haverfordwest	5·41	— ·45	1·18	11	23	55·4	19	29·8	29	4	6
,,		Carno (Tybrith)	3·55	— 2·41	·55	11	18	47·0	18	19·0	22	14	...
,,		Llandudno.....	3·83	+ ·74	·67	15	18	59·0	18	32·5	23	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	4·96	+ ·40	·82	8	13	55·4	2	23·0	27	7	...
,,		Jedburgh (Sunnyside).....	2·23	— ·27	·49	11	13	56·0	3	23·0	27	...	...
XIV.		Old Cumnock	4·56	— ·41	·90	11	21	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	5·29	— 2·00	·83	18	19	...	...	23·0	26	9	...
,,		Oban (Craigvarren)	5·05	...	·81	8	20	57·8	1	27·9	26	3	...
,,		Mull (Quinish).....	5·89	— 1·10	·69	8	19	...	...	...	...	...	...
XVI.		Loch Leven Sluices	3·60	— ·36	·70	12*a*	11	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	3·05	+ ·35	·80	11	11	51·0	20	27·3	28	8	...
XVII.		Braemar	3·45	— 1·13	1·00	11	18	49·0	19	16·4	25	11	22
,,		Aberdeen (Cranford)	4·30	...	·88	11	23	51·0	2, 7	24·0	27	8	...
XVIII		Strome Ferry.....	6·47	— 1·41	·90	8	18	...	..	...	...	...	...
,,		Inverness (Culloden)	·34	— 2·15	...	...	...	49·0	8, 19	27·0	25	10	27
XIX.		Dunrobin	2·67	— ·16	1·27	11	13	50·0	1	28·0	26	11	...
,,		S. Ronaldsay (Roeberry).....	2·87	— ·55	1·17	11	19	52·0	1	36·0	24*f*	0	...
XX.	IRELAND.	Dromore Castle	4·84	— ·84	1·52	28	14	55·0	10*d*	33·0	12*g*	0	...
,,		Waterford (Brook Lodge) ...	5·51	+ 1·84	1·62	10	17	54·5	18	26·0	23*h*	6	..
,,		O'Briensbridge (Ross)	2·43	...	·55	12	17	47·0	13	29·0	23	17	..
XXI.		Carlow (Browne's Hill)	3·63	+ ·57	1·10	10	17	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	2·91	+ ·08	1·23	10	15	57·8	18	31·4	24	3	16
XXII.		Ballinasloe	2·23	— 1·68	·42	10*b*	18	56·0	28	24·0	24	18	...
,,		Clifden (Kylemore)	7·82	...	1·22	27	22	..	...	...	...	...	...
XXIII		Waringstown	2·55	— ·55	·49	27	17	55·0	18	26·0	27	15	18
,,		Londonderry (Creggan Res.).	2·67	— 1·85	·37	10	24	...	...	...	...	...	...
,,		Omagh (Edenfel).....	2·66	— 1·21	·38	10	22	49·0	18	29·0	23	7	13

a And 14. *b* And 27. *c* And 19. *d* And 14, 20 & 22. *e* And 30. *f* And 25. *g* And 14, 18 & 20. *h* And 26.

+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON NOVEMBER, 1891.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail. S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—A fairly seasonable month, with about an average rainfall. A remarkable fall of the bar. of about 1·7 in. occurred between the 8th and the 11th. Gales on the 10th and 11th. Primroses in bloom on 13th, and blackbirds singing on 22nd.

HITHIN.—The most severe gale ever experienced here, occurred on the 11th.

ADDINGTON.—There were very few fine days during the month. On the 11th a heavy gale occurred, uprooting many trees; the bar. was very low at 9 a.m. (28·444 in. corrected), and continued to fall until after midday; a rapid rise set in during the afternoon. Dense fog on 24th and 30th.

BURY ST. EDMUNDS, WESTLEY.—A mild, foggy month, with frequent R in small quantities. Remarkable for the very high reading of the bar. on the 5th, and the very low reading on the 11th. S on 26th.

LANGTON HERRING.—The feature of the month was the great storm on the 11th and 12th, when many trees were uprooted; no loss of life, however, occurred on this coast. The mean temp. at 9 a.m. was 1°·1 below the average of 19 years. From the 1st to the 7th inclusive very fine weather prevailed, but the rest of the month was showery.

BODMIN.—Dry and cold during the first week, but rainy and stormy from the 7th to the end of the month, and very cold on some days. Frost and fog on the 24th and four following days.

WOOLSTASTON.—A dark, foggy month. An exceptionally rapid fall of the bar. on the morning of the 11th was followed by a very severe gale, which raged for seven or eight hours, and did not subside till the following evening. S fell on the 26th. Mean temp. 40°·6.

TENBURY, ORLETON.—The beginning and end of the month were fine and dry, but a good deal of R fell in the middle—*i.e.*, from 8th to 18th. A great gale occurred on the 11th, with the lowest bar. since December, 1886. Severe frost prevailed from the 22nd to the end of the month, the mean temp. for the 8 days being 33°. The mean temp. of the month was 2° below the average and the lowest in November during 10 years, except 1887. Fog on 2nd, 24th, 25th, 29th, and 30th.

LEICESTER, BARKBY.—Several days of very thick fog occurred. Mean temp. 40°·7; corrected bar. on the 11th, 28·29 in.

MANCHESTER, PLYMOUTH GROVE.—Fine autumn weather on the 2nd, 12th and 14th; heavy fog all day on the 6th and 27th; wet mist and heavy fog on the 23rd and 29th; very stormy on the 11th; S and sleet on the 26th. Mean temp. 42°.

SKIPTON, ARNCLIFFE.—Stormy, with the lowest bar. pressure of the year on the night of the 10th.

WALES.

HAVERFORDWEST.—The first week was fine, dry and pleasant, with clear and cold nights; the rest of the month was a constant succession of R, gales, and mildness. The gales of 9th & 10th, and 12th & 13th were of great violence, and the corrected reading of the bar. at 8.30 a.m. on 11th was 28·390 in. The month may be summed up as mild, very stormy and wet, though the total R has been exceeded. Prevailing winds, S. and S.W.

SCOTLAND.

CARGEN.—A very wet and gloomy month; only 46 hours of sunshine, the average being 84 hours. The bar. pressure was unusually high for the first week, with easterly winds, fogs, and no sunshine. The remainder of the month was very wet and stormy, impeding agricultural work, which, owing to the wet October, was very backward. H on the 24th.

JEDBURGH.—The weather was generally calm, with little sunshine, a good deal of fog about the middle of the month, and almost continuous rainfall. Out-door work was never stopped.

OLD CUMNOCK.—Fog on the 3rd and 4th; stormy on the 11th; H on 16th; H and S on 25th and 26th.

S. RONALDSAY, ROEBERRY.—A very fine month upon the whole.

IRELAND.

WATERFORD, BROOK LODGE.—Mean temp. 42°·9.

O'BRIENSBRIDGE, ROSS.—Calm and foggy days, with low temp., occurred up to the 9th, followed by R and high winds, and a severe gale on the 12th. Frosts slight during the month, and a considerable rise of temp. at the close.

DUBLIN.—Opening with a week of quiet, fine, dry, anticyclonic weather, this month ultimately proved very cold and changeable. On the 11th, a disastrous cyclone occurred, causing destructive gales. After this date, the temp. remained low to the end of the month with one or two exceptions, and R fell frequently, though not as a rule heavily. Mean temp. 43°·4, High winds occurred on nine days, and attained the force of a gale on three occasions, 11th, 12th, and 28th. Prevailing direction, S.W. and W. Fogs on eight days.

BALLINASLOE.—Heavy gales and R on 12th and 27th. Fogs from 13th to 16th.

KYLEMORE.—Stormy and wet from S. on the 7th, and from N.W. on 10th. Very stormy also on the 27th.

OMAGH, EDENFEL.—The month commenced with ideal late-autumn weather, calm, fine, often bright, and without night frosts, and although more or less R fell daily from the 8th to the end (excepting 14th and 15th), it did not interfere with outdoor work.

ANALYSIS OF RAIN COLLECTED IN ENGLISH TOWNS.

WE understand that Mr. W. H. Watson, F.C.S., of The Folds, Bolton, desires the co-operation of a few careful rainfall observers in our large towns and cities, each of whom is to collect all the rain and snow found in his gauge during 1892, and to send it to Mr. Watson in two consignments, one in July (the rain from Jan. 1 to 9 am. July 1), and the other in January, 1893 (the rain in the second half of 1892). Those who may find it inconvenient to do this for the entire twelve months would much oblige by undertaking the careful collection of the rain up to July 1st. Mr. Watson will readily reply to any letters from observers willing to help.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCCXII.] JANUARY, 1892. [PRICE FOURPENCE, *or 5s. per ann. post free.*

ANEROID BAROMETERS.

IT is somewhat remarkable that the principal works on the Aneroid barometer have been written by those who were not meteorologists. The work which Mr. Whymper, the well-known traveller and engraver, has just issued* is another and striking example of the same rule. It is a remarkable book, and one which, by its thorough demonstration of facts, not altogether unknown but not previously attended to, will form a distinct epoch in the use of the Aneroid at great altitudes by all who care for accuracy. Briefly, the scope of the work is as follows:—The author, in his travels amongst the great Andes of the Equator, took with him two mercurial barometers and several aneroids. He found that the readings of the aneroids ran away from those of the mercurials because they took time to fall to their lowest point, and this time allowance had not been made in their original graduation, is not recognised in the certificates issued at Kew, and has not hitherto been allowed for. As far as we can see, it is merely the effect of imperfect elasticity in the vacuum boxes, and possibly chemists and meteorological instrument makers between them will be able to find an alloy which may minimize the evil.

Although we have put in these very few words that which seems to us to be the essential feature of Mr. Whymper's work, and it is easy enough to do so when he has marshalled all the facts, we wish to impress upon all who intend to use aneroids at heights exceeding 1,000 ft. or so that they must read and master his book if they desire to get the best results from their instruments. Mr. Whymper has been working at this subject for many years; he gives the results of dozens of aneroids, some tested in his travels and many more compared in his workshop, where they have been kept at low pressures for weeks and even months, and he gives page after page of tables, proving his case with a thoroughness which, as far as we can see, leaves no loophole for doubt. And the results are very bad. He shows that it is possible to determine an altitude and make it too

* "How to use the Aneroid Barometer," by EDWARD WHYMPER. London: J. Murray. Med. 8vo., 61 pages.

much by 2,000 feet. Happily, he also shows how great errors may be avoided.

Mr. Whymper seems to expect a degree of accuracy which is far in excess of what appears to us reasonable. On page 17 he gives the errors of a series of six watch aneroids to thousandths of an inch. They must have been read under a microscope! These aneroids were kept at 22½ inches for some weeks. Mr. Whymper tells us elsewhere that aneroids become untrustworthy near their lowest graduation, so we shall probably do him no injustice if we assume that these instruments were graduated to show from 21 in. to 31 in. —*i.e.*, 10 inches. By actual measurement of three aneroids of the same size (2-inch), we find that the divided circles have diameters of 1·60, 1·60, and 1·65 inches; therefore their circumferences are 5·03, 5·03, and 5·18 inches respectively; there is usually a little space between the two ends of the scale, and consequently we are more than justified in saying that each inch of pressure is, on these aneroids, represented by less than half an inch of linear space. Hence it follows that the thousandths of an inch in Mr. Whymper's table represent a two thousandth of an inch of linear space—to get readings like that, without either a vernier or a microscope, is simply impossible. Why, the hands of the aneroid have a breadth of about ·01 in., so that the readings are taken to 1-20th of the breadth of the hand. We never previously saw the readings of watch aneroids published to three places of decimals, and think that it would have been better to have stopped at two places—even that would imply reading accurately *without a vernier* to the 1-200th part of a linear inch—say to about half the breadth of a human hair.

The monograph would be improved also by a series of diagrams giving graphic representations of the values in the tables; but taken as it is, we welcome it as an extremely valuable contribution to meteorology and to physical geography.

The question now remains, how is the error to be dealt with and removed? It closely resembles the difficulty which for half a century attached to mercurial thermometers in what was known as the change of zero, and the parallelism is very close. Mr. Whymper does not publish a series of comparisons hour by hour for, say, two or three days, but from the values he gives, it seems to us that just as Denton's process has given us mercurial thermometers with constant zeros, so aneroids should not be pointed off in an afternoon, but placed under reduced pressure for some time before being graduated.

One optician has given us clinical thermometers advertised as taking up the true temperature in one minute. Will not he or some one else give us aneroids which will show the true pressure on a 10,000 feet mountain in something less than a month?

That the issue of certificates for aneroids must be reconsidered, and in all probability the charge for them considerably increased, seems obvious; but beyond everything in importance is the discovery of the best material of which to make the vacuum boxes—therein lies a handsome income for the lucky discoverer.

ROYAL METEOROLOGICAL SOCIETY.

The usual monthly meeting of this Society was held on Wednesday evening, December 16th, at the Institution of Civil Engineers, Mr. Baldwin Latham, M. Inst. C.E., President, in the chair.

Mr. R. H. Hooker, B.A., Mr. A. B. MacDowall, M.A., Mr. E. G. Ravenstein, F.R.G.S., and Mr. R. Hedger-Wallace were elected Fellows of the Society,

Mr. W. Marriott gave the results of the investigation undertaken by the Society into the thunderstorms of 1888 and 1889, which he illustrated by a number of lantern slides. The investigation was originally confined to the south-east of England, but as this district was found to be too circumscribed it became necessary to include the whole of England and Wales. After describing the arrangements for collecting the observations and the methods adopted for their discussion, Mr. Marriott gave statistics showing the number of days on which thunderstorms occurred at each station; the number of days of thunderstorms in each month for the whole country; the number of days on which it was reported that damage or accidents from lightning occurred; and also the number of days on which hail accompanied the thunderstorms. In 1888 there were 113 days, and in 1889, 123 days on which thunderstorms occurred in some part of the country. The number of days with damage by lightning was in 1888 33, and in 1889 38; and there were 56 days in each year on which hail accompanied the thunderstorms. The tables of hourly frequency show that thunderstorms are most frequent between noon and 4 p.m., and least frequent between 1 a.m. and 7 a.m. Thunderstorms appear to travel at an average rate of about 18 miles an hour in ill-defined low barometric pressure systems, but at a higher rate in squally conditions. The author is of opinion that individual thunderstorms do not travel more than 20 miles; and that they take the path of least resistance, and are consequently most frequent on flat and low ground. Isobaric charts, with isobars for each two-hundredths ($\frac{1}{50}$th) of an inch were prepared for 9 a.m., and 9 p.m. each day for the month of June, 1888. An examination of these charts showed that instead of the pressure being so very ill-defined, as appeared on the daily weather charts, there were frequently a number of small but distinct areas of low pressure, or cyclones with regular wind circulation, and that these small cyclones passed over the districts from which thunderstorms were reported. Sometimes it is not possible to make out well-formed areas of low pressure from two-hundredths of an inch isobars, but there is a deflection of the wind which shows that there is some disturbing cause; and thunderstorms usually have occurred in that immediate neighbourhood. The author believes that the thunderstorms formation are small atmospheric whirls—in all respects like ordinary cyclones, and that the whirl may vary from one mile to ten miles or more in diameter. There are frequently several whirls near together, or following one another

along the same track. The numerous oscillations in the barometric curve are evidently due to the passage of a succession of atmospheric whirls; and it appears that lightning strokes are most frequent when these occillations are numerous.

Mr. F. J. Brodie read a paper "*On the Prevalence of Fog in London during the Twenty Years* 1871 *to* 1890. The popular notion that November is the month of most frequent fog, is not confirmed by the figures given by the author. The number of fogs in that month is, if anything, slightly less than in October or January, and decidedly less than in December, the last-mentioned month being certainly the worst of the whole year. The latter part of the winter is not only less foggy than the earlier part, but is clearer than the autumn months. In February the average number of days with fog is only 6·6, as against 8·9 in January, 10·2 in December, 9·2 in October, and 8·8 in November.

THE MUNICH CONFERENCE.*

The following summary from *Nature* of the principal subjects discussed, and decisions arrived at, will complete our notice of the above meeting.

Temperatures.—All temperatures published after 1901 are to be referred to the readings of the air thermometer.

Sun Thermometers.—Actinometrical observations are not held to be sufficiently certain to justify their general introduction.

Hygrometers.—The application of a ventilating arrangement to wet-bulb thermometers was recommended.

Rain.—It was decided to count as days of rain those on which 0·005 inch (0·1 mm.) of rain was measured, and to print monthly the number of days on which 0·05 inch (or 1 mm.) fell.

Snow.—A note is to be made in the monthly schedules of the number of days on which about half the country surrounding the station is under snow.

Clouds.—A new classification of clouds to replace Howard's, proposed by Prof. Hildebrandsson and the Hon. R. Abercromby, was adopted by a large majority, England and the United States being dissentients. A committee was then appointed to consider the question of typical cloud pictures in general, taking the above classification more or less as a basis of arrangement. A report also was received and adopted on the observation of the motions, &c., of cirrus and other high-level clouds.

Wind.—Robinson's anemometer was the only form of instrument discussed. It was decided that no instrumental results should be published unless the instrument had been previously compared with a standard, either directly or indirectly.

* See also pp. 148 and 168.

Time.—A proposal to recommend the adoption of universal or zone time was emphatically rejected on the ground that local time alone can be used for climatological inquiry. It was further decided to insist that in all publications the day should commence with midnight as 0 hours.

Gravity correction.—It was decided to introduce the practice of correcting barometrical readings for the force of gravity at lat. 45° after the beginning of the year 1901.

Terrestrial Magnetism.—The questions relating to this subject were referred by the Conference to a special sub-committee, whose decision will appear in the published report of the proceedings.

Mr. Wragge, for Queensland, and Captain Pinherio, for Brazil, gave interesting notices of what is being done for meteorology in their respective countries.

It was resolved that an International Meteorological Committee should be constituted to prepare for a possible Congress in Paris in the year 1896. The Committee is to consist of 17 members, of whom 14 were elected, and it was decided to fill the 3 vacancies by the co-option of extra-European meteorologists. The officers of the Committee—Messrs. Wild and Scott—were re-appointed.

INSIDE A WATERSPOUT.

IN our November number (p. 151) we quoted from the *Leisure Hour* a very interesting account of the sensations of a young officer of the "Crest of the Wave," when inside a water-spout, in the year 1855. Through the kindness of Mr. R. H. Scott, F.R.S., we have received a copy of the account of the same event, as written by the captain, in the ship's log, which is still preserved at the Meteorological Office, and which we print verbatim.—ED.

Extract from the Meteorological Register kept on board the "Crest of the Wave," CAPTAIN JOHN STEELE.

1855, *August 20th.*—At 7 a.m., when in Lat. 35° 50′ N., Long. 19° 42′ E., or 138 miles W.¼S. from Cape Matapan, passed under a waterspout. At 6 a.m. heavy squall-like cloud forming at S.E. and N.W., a waterspout forming at east end of S.E. squall, and another at west end of N.W. squall, both squalls closing upon the ship. Up till this time the weather had been clear, with an almost cloudless sky, and light but steady wind from W.S.W. All studding sails had been set during the night. At 6.30 took in studding sails and all light sails, hauled up courses, and stood by topsail haulyards and jib down-haul. Waterspout now near at hand, direct ahead, and coming fast upon us; let fly topsail haulyards, and had got the jib about half down, when it struck us on the port bow, fulling staysail and jib to starboard, but pressing fore-yard fast aback, in another instant fulling head-yards and pressing main yard aback, and again throwing main and mizen-yards full and aback, at the same instant

whirling along port side with a violent gust and round the stern with a loud noise, throwing water into the stern windows as it passed. A moment after there was a calm, then heavy gusts, succeeded by a heavy squall and much rain from E.S.E. The waterspout waved and bent to the whirling wind, and in its action was like a huge transparent chimney, in which the water, "smoke-like," was curling its way to heaven. I had time to view it, and was much struck with the curling vapour rolling up its glass-like tube. I have heard it stated that any body passing through a waterspout would burst it; this one had half its base acting upon my ship, but still remained perfect in form and action.

RAINFALL AT LEON, GUANAJUATO, MEXICO.

WE notice in the May number of the *Memorias de la Sociedad Cientifica "Antonio Alzate"* two tables of the rainfall of Léon, which may be of interest to some of our readers. Léon is in Lat. 21° 7′ 24″ N., Long. 101° 10′ 44″ W., and 5,901 feet above sea-level. It is therefore on the high land of Mexico, and about 200 miles N.W. of the capital.

The tables show that the mean rainfall is about 30 inches, falling on 123 days, and that the driest year had 81 per cent. of the mean, and the wettest 120 per cent. of it. Unless, therefore, there was something exceptional in the rainfall of the 13 years 1878-90, it is evident that the annual rainfall in Guanajuato is much less variable than in this country.

Professor Leal, under whose directions the observations have been made, gives no details respecting the rain gauge or its position, nor does he give the fall for each month or the mean monthly fall. It would be satisfactory if he would supply this information in a subsequent paper. In its absence we have thought it well to add the monthly fall for 1890, which is given in another part of the same number of the *Memorias*.

YEARLY RAINFALL.

Year.	Depth. in.	Days.
1878	24·43	92
1879	27·92	100
1880	32·50	119
1881	24·80	127
1882	27·53	117
1883	35·47	134
1884	24·14	111
1885	30·95	130
1886	28·23	97
1887	30·79	136
1888	34·24	152
1889	30·22	134
1890	34·14	145
Mean	29·64	123

RAINFALL IN 1890.

Months.	Depth. in.
January	·04
February	·01
March	·24
April	·04
May	·27
June	8·88
July	6·46
August	5·35
September	7·28
October	4·41
November	·78
December	·38
Total	34·14

ORDNANCE BENCH MARKS.

To the Editor of the Meteorological Magazine.

SIR,—May I draw the attention of Borough Surveyors, and Surveyors under the County Councils in particular, to the fact that many of the Ordnance Survey marks are being removed, through walls being pulled down and alterations made in buildings. Should any reader notice anything being done to a place where a mark is known to exist, would he adopt my plan and send at once to the architect engaged, because it is not a difficult matter then to measure its position exactly and replace it. If it be impossible to replace the brick or stone with the mark on, in its original position, a simple arrow ∧ without the cross line might be cut with its point as nearly as possible to the former position of the Ordnance Survey mark, then it would be seen at a glance that it was not the original, and had been interfered with.—Yours faithfully,

JOHN J. GILBERT, A.I.C.E., F.R.Met.Soc., &c.

72, *Cambridge Street, The Crescent, Birmingham. Dec.* 22*nd*, 1891.

[The evil is a serious and growing one. Scores of Ordnance Bench Marks must be removed every year, and eventually all those quoted in the useful volumes "*Abstracts of Spirit Levelling*," will have vanished. A bench mark moved may, however, be worse than none at all; we heard of one rebuilt two feet too high and which, on the fact being reported to the Ordnance Survey Office, the Director promptly sent and had defaced so that it should do no more mischief. For rough work Mr. Gilbert's suggestion, if carefully carried out, would be useful, but perhaps it would be better either to put the mark wrong side up or to enclose it in a ring. We fancy that there is a section in the Survey Act prohibiting any one but the officers of the Survey cutting such a mark—if there is not there ought to be. But we have always pleaded for the adoption in this country of the French plan of affixing a metal plate stating in raised figures its own altitude.—ED.]

THE UNITED STATES WEATHER BUREAU.

To the Editor of the Meteorological Magazine.

SIR,—Referring to the kind and appreciative notice of my special report on p. 171 of your magazine, I must hasten to set you right respecting your understanding of that portion relating to rain-gauges. I assure you there is no lack of expert supervision, both as to the accuracy of the gauges themselves as instruments, and as to their use and exposure of stations, for all of which duties the official in charge of instruments is responsible.

The bulky and less delicate character of rain-gauges, as compared with thermometers, barographs, &c., and the large number issued by the Bureau, makes it more convenient to place the actual shipment of these instruments in the hands of our Property Clerk.

Very respectfully yours,

MARK W. HARRINGTON,

Chief of Weather Bureau.

Weather Bureau, Washington D C.. Dec. 30*th*, 1891.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JUNE, 1891.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum Temp.	Absolute. Minimum Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	79·0	22	44·9	10	71·5	52·2	50·6	71	125·9	38·9	8·02	10	5·4
Malta	99·6	7	58·3	2	83·0	64·5	59·6	66	155·7	50·0	·02	1	2·7
Cape of Good Hope	78·2	1	37·7	30	62·0	49·4	...	...	...	...	3·16	12	6·1
Mauritius	76·6	24	58·3	1	74·8	65·1	62·6	79	128·5	51·3	2·55	24	4·8
Calcutta	98·1	14	74·4	8*a*	93·3	80·6	79·9	81	156·5	72·8	5·94	9	5·5
Bombay	93·2	7	76·0	29	90·5	81·6	77·0	76	141·6	72·0	13·99	14	5·4
Ceylon, Colombo	87·0	11	73·3	19	84·2	78·9	71·4	76	147·8	70·0	9·79	19	7·7
Melbourne	60·5	23	35·2	9	56·6	45·7	47·0	86	108·6	30·4	2·54	15	7·7
Adelaide	63·5	1	36·2	23	59·8	44·5	43·3	72	127·0	27·2	1·44	13	5·5
Tasmania, Hobart	58·8	29	33·2	9	53·2	42·5	44·5	92	108·0	27·8	1·40	20	6·9
Wellington	59·5	8	32·0	26	52·7	38·3	41·6	87	98·0	22·0	2·89	15	4·0
Auckland	63·0	5	39·0	15	56·9	44·8	41·8	72	113·0	30·0	1·47	10	5·5
Jamaica, Kingston	90·9	5	72·2	8	87·7	74·9	71·6	71	...	...	6·47	...	...
Trinidad	97·0	7	68·0	22	85·9	72·0	72·1	76	154·0	58·5	5·54	21	...
Toronto	91·9	16	42·5	4	74·6	54·3	54·1	68	...	33·0	3·05	11	5·0
New Brunswick, Fredericton	86·0	16	37·0	5	69·5	48·6	50·7	69	...	...	3·20	14	7·3
Manitoba, Winnipeg	84·0	22	34·8	4	71·3	49·9	51·5	72	...	...	4·56	15	5·8
British Columbia, Esquimalt	72·1	25	39·4	8	63·1	48·8	51·7	88	...	...	1·26	13	6·1

a And 28.

REMARKS.

MALTA.—Mean temp. 72°·3; mean hourly velocity of wind 7·2 miles. Sea temp. rose from 66°·5 to 75°·5. L on 18th. Screen temp. 90° on 5 days. Sun max. 150° on 5 days. J. SCOLES.

Mauritius.—Mean temp. of air 0°·2 below; dew point 1°·9 above; and R ·63 in above, their respective averages. Mean hourly velocity of wind 9·1 miles, or 2·2 below average; extremes, 21·9 on 29th and 1·6 on 12th; prevailing direction S.E. to E. by S. T and L during night of 13th and morning of 14th. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—L was seen on 6 days. J. C. H. CLARKE, Lt.Col.R.E.

Melbourne.—Mean temp. of air 1°·4, of dew point 3°·4, humidity 6, R ·57 in., and cloud 1·1 above their respective averages. Prevailing wind S.E. and S.; strong on 7 days. Heavy dews on 9 days. Hoarfrost on 21st. Fog on 6 days.

R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 1°·4, and R 1·40 in. below the average of 34 years.

C. TODD, F.R.S.

Wellington.—Showery in the early part of the month, fine in the latter, with cold, frosty nights and clear skies. Prevailing southerly wind, but light or calm, except fresh on 1st from S.W. Earthquake on 2nd at 4.25 a.m., and on 30th, at 4.55 p.m., slight. Mean temp. 3°·5 and R 2·33 in. below the average. R. B. GORE.

Auckland.—The first week of the month was stormy and squally, but from thence to the close settled fine weather prevailed, with bright, sunny days, and cold frosty nights. Mean temp. the lowest recorded for the month. Rainfall not much more than a quarter of the average, and the smallest since 1859. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL, DECEMBER, 1891.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall.	4·62	XI.	Builth, Llanwrtyd Wells	11·00
,,	Margate, Birchington...	...	,,	Rhayader, Nantgwillt..	12·91
,,	Brighton, Prestonville Rd	2·70	,,	Corwen, Rhug	6·88
,,	Hailsham	4·15	,,	Carnarvon, Cocksidia ...	8·29
,,	Ryde, Thornbrough	4·93	,,	I. of Man, Douglas	8·69
,,	Alton, Ashdell.....	5·64	XII.	Stoneykirk, Ardwell Ho.	3·79
III.	Oxford, Magdalen Col...	2·99	,,	New Galloway, Glenlee	10·93
,,	Banbury, Bloxham	4·14	,,	Melrose, Abbey Gate ...	6·07
,,	Northampton	2·92	XIII.	N. Esk Res. [Penicuick]	9·15
,,	Cambridge, Fulbourne..	3·12	XIV.	Ballantrae, Glendrishaig	6·06
,,	Wisbech, Bank House..	2·72	,,	Glasgow, Queen's Park.	6·68
IV.	Southend	1·92	XV.	Islay, Gruinart School..	7·21
,,	Harlow, Sheering	3·39	XVI.	Dollar.....	6·59
,,	Rendlesham Hall	2·83	,,	Balquhidder, Stronvar..	13·04
,,	Diss	3·02	,,	Coupar Angus Station..	2·95
,,	Swaffham	3·49	,,	Dunkeld, Inver Braan..	5·61
V.	Salisbury, Alderbury ...	4·18	,,	Dalnaspidal H.R.S. ...	10·18
,,	Warminster	...	XVII.	Keith H.R.S.	·91
,,	Bishop's Cannings	4·90	,,	Forres H.R.S.	1·62
,,	Ashburton, Holne Vic....	11·37	XVIII.	Fearn, Lower Pitkerrie.	2·45
,,	Okehampton, Oaklands.	7·58	,,	Loch Shiel, Glenaladale	...
,,	Lynmouth, Glenthorne.	9·42	,,	N. Uist. Loch Maddy ...	...
,,	Probus, Lamellyn	4·56	,,	Invergarry	11·77
,,	Launceston, S. Petherwin	...	,,	Aviemore H.R.S.	3·91
,,	Wincanton, Stowell Rec.	4·61	,,	Loch Ness, Drumnadrochit	5·26
,,	Wells, Westbury.....	...	XIX.	Lairg H.R.S.	2·30
VI.	Bristol, Clifton	4·63	,,	Scourie	5·77
,,	Ross, The Graig	3·56	,,	Watten H.R.S.	2·91
,,	Wem, Clive Vicarage ...	3·32	XX.	Dunmanway, Coolkelure	12·69
,,	Cheadle, The Heath Ho.	5·05	,,	Fermoy, Gas Works ...	5·69
,,	Worcester, Diglis Lock	3·13	,,	Darrynane Abbey.....	7·32
,,	Coventry, Coundon	3·31	,,	Tipperary, Henry Street	...
VII.	Ketton Hall [Stamford]	2·85	,,	Limerick, Kilcornan ...	4·80
,,	Grantham, Stainby	3·11	,,	Ennis	6·96
,,	Horncastle, Bucknall ...	3·01	,,	Miltown Malbay.....	7·64
,,	Worksop, Hodsck Priory	3·37	XXI.	Gorey, Courtown House	6·30
VIII.	Neston, Hinderton	4·21	,,	Mullingar, Belvedere ...	5·89
,,	Knutsford, Heathside...	4·44	,,	Athlone, Twyford	5·71
,,	Lancaster	6·48	,,	Longford, Currygrane...	5·32
,,	Broughton-in-Furness..	11·00	XXII.	Galway, Queen's Coll...	7·76
IX.	Ripon, Mickley	4·68	,,	Crossmolina, Enniscoe..	7·21
,,	Scarborough, West Bank	2·78	,,	Collooney, Markree Obs.	4·95
,,	East Layton [Darlington]	3·16	,,	Ballinamore, Lawderdale	6·03
,,	Middleton, Mickleton..	5·54	XXIII.	Lough Sheelin, Arley ..	5·80
X.	Haltwhistle, Unthank..	6·08	,,	Warrenpoint	3·22
,,	Bamburgh.....	3·17	,,	Seaforde	5·41
,,	Shap, Copy Hill	...	,,	Belfast, New Barnsley..	5·45
XI.	Llanfrechfa Grange	7·13	,,	Bushmills, Dundarave...	3·49
,,	Llandovery	9·03	,,	Stewartstown	5·39
,,	Castle Malgwyn	8·10	,,	Buncrana	4·64

DECEMBER, 1891.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max Deg.	Date	Min. Deg.	Dat	No. of Nights below 32° In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	3·24	+ 1·17	·70	1	18	57·2	5	16·8	22	10	17
II.		Maidstone (Hunton Court)...	2·76	+ ·52	·48	1	18	...	...	...	...	...	...
,,		Strathfield Turgiss	3·81	+ 1·80	·84	1	20	55·9	5	18·2	20	13	18
III.		Hitchin	3·56	+ 1·53	·83	13	20	55·0	3, 5	13·0	24	10	...
,,		Winslow (Addington)	3·66	+ 1·21	·77	1	21	57·0	5	12·0	22	12	17
IV.		Bury St. Edmunds (Westley)	3·02	+ ·78	·57	1	19	...	...	...	...	...	...
,,		Norwich (Cossey)	2·90	+ ·67	·53	1	16	...	...	13·0	22	9	14
V.		Weymouth(LangtonHerring)	3·97	+ ·87	·88	1	22	55·0	3	26·0	21*b*	7	...
,,		Barnstaple	3·16	— 1·53	·61	14	16	58·0	4, 6	23·0	24	...	..
,,		Bodmin (Fore Street)	7·58	+ 2·24	·98	29	23	...	...	...	...	...	...
VI.		Stroud (Upfield)	3·04	+ ·59	·40	1	22	55·0	3	19·0	22	13	...
,,		ChurchStretton(Woolstaston)	4·61	+ 1·56	·70	9	21	54·0	3	14·0	25	12	20
,,		Tenbury (Orleton)	3·62	+ 1·25	·67	12	19	58·7	3	14·0	23	12	17
VII.		Leicester (Barkby)	3·33	+ 1·19	·52	30	21	56·0	3	11·0	21	15	24
,,		Boston	2·34	+ ·49	·68	1	13	55·0	3	15·0	22	13	...
,,		Hesley Hall [Tickhill].....	3·13	+ 1·15	·66	13	19	56·0	3	12·0	23*a*	15	...
VIII.		Manchester(PlymouthGrove)	5·71	+ 2·27	·80	30	21	55·0	3	16·0	24	10	17
IX.		Wetherby (Ribston Hall) ...	3·23	+ ·79	·96	10	12	...	...	...	...	...	...
,,		Skipton (Arncliffe)	10·79	+ 3·98	1·86	9	22	58·0	5	16·0	25	9	...
,,		Hull (PearsonPark)	3·35	+ 1·08	·65	13	19	56·0	3	18·0	25	12	18
X.		Newcastle (Town Moor)	3·48	+ 1·18	1·50	7	14	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	25·25	+ 7·44	3·15	8	23	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	7·23	+ 2·68	·99	30	22	...	...	...	...	...	...
,,		Haverfordwest	7·87	+ 2·88	1·25	13	23	54·8	4	21·0	25	8	9
,,		Carno (Tybrith)	11·51	+ 5·62	1·60	9	22	48·0	3	7·0	23	15	...
,,		Llandudno.....	4·92	+ 1·96	·70	9	17	58·5	3	23·0	25	7	...
XII.	SCOTLAND.	Cargen [Dumfries]	6·91	+ 2·89	·88	12	18	53·6	4	22·4	22	10	...
,,		Jedburgh (Sunnyside).....	4·92	+ 2·72	·94	7	18	50·0	1, 4	15·0	25	16	...
XIV.		Old Cumnock	7·31	+ 2·24	·88	15	22	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory).....	9·44	+ 2·07	1·19	9	24	...	...	27·0	7	12	...
,,		Oban (Craigvarren)	9·45	...	·95	10	24	54·0	2	32·8	8	0	...
,,		Mull (Quinish).....	9·74	+ 2·17	1·20	15	23	...	...	...	...	...	...
XVI.		Loch Leven Sluices	5·50	+ 2·19	·90	10	16	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	3·55	+ 1·47	·70	10	15	50·1	3	23·7	17	13	...
XVII.		Braemar	4·20	+ 1·73	·75	9	19	50·2	3	16·0	15*a*	19	25
,,		Aberdeen (Cranford)	2·13	...	·57	15	16	53·0	3	22·0	24	14	...
XVIII		Strome Ferry.....	9·71	+ 1·92	·91	3	23	...	...	...	...	...	...
,,		Inverness (Culloden)	2·48	+ ·55	...	...	...	59·0	26	26·0	17	8	28
XIX.		Dunrobin	3·32	— ·05	·66	15	15	49·0	1	25·5	8	17	...
,,		S. Ronaldsay (Roeberry).....	3·54	— ·12	·49	15	21	51·0	3	32·0	30	...	...
XX.	IRELAND.	Dromore Castle	6·63	·00	·80	11	19	50·0	20	28·0	26	..	...
,,		Waterford (Brook Lodge) ...	6·38	+ 2·74	1·36	12	22	54·0	3, 30	29·5	12	4	..
,,		O'Briensbridge (Ross)	7·40	...	1·23	9	21	47·0	4	27·0	24	12	..
XXI.		Carlow (Browne's Hill)	5·44	+ 2·32	·93	12	19	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	3·30	+ 1·14	·75	6	21	58·0	3	25·2	22	6	15
XXII.		Ballinasloe	6·95	+ 3·53	1·26	9	24	49·0	2, 3	24·0	25	16	...
,,		Clifden (Kylemore)	10·49	...	1·25	25	26	..	...	...	...	...	...
XXIII		Waringstown	4·34	+ 1·30	·73	12	24	54·0	4	23·0	21	16	19
,,		Londonderry (Creggan Res.).	4·52	+ ·31	1·00	10	22	...	...	...	...	..	...
,,		Omagh (Edenfel).....	5·62	+ 1·94	·76	9	23	52·0	2, 3	27·0	24	7	18

a And 25. *b* And 24.

+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON DECEMBER, 1891.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. fo Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail. S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—With the exception of a week's winter weather to remind us of Christmas time December was mild and genial. The land was very wet and agricultural matters are greatly in arrear.

ADDINGTON.—From the 1st to the 15th a great quantity of R fell, causing large floods; the temp. being high, and the wind often strong. On the 17th frost set in with considerable severity, and was very intense from the 21st to the 25th, the ice on the lake being 4½ inches thick. On the 26th a thaw set in lasting until the end. On the 31st at 9 a.m. the ther. stood at 48°, and the min. for the night was 44°.

BURY ST. EDMUNDS, WESTLEY.—The month was mild except from the 19th to the 25th, when a sharp frost prevailed, which was severe enough to spoil many of the white turnips.

LANGTON HERRING.—The first half of the month was wet, stormy and mild; this was followed by a spell of fine dry cold weather from the 17th to the 25th; the last week was mild and wet. The mean temp. of the month is 2°·7 above the average of 19 years, and on 17 days the temp. rose to or above 50°. Gales occurred on the 7th, 9th, 10th and 13th; L on the 10th; fog on 24th.

BODMIN.—R fell daily from the 1st to the 15th; it was dry from the 15th to the 23rd; frost prevailed from the 19th to the 24th, and then R to the end of the month. A very wet month and very stormy at times, especially on 9th, 10th, 12th and 13th; H on the 12th.

STROUD, UPFIELD.—Gales on the 8th, 9th, 10th, 12th and 13th; heavy on the latter day, when several great elm trees were blown down.

WOOLSTASTON.—A succession of gales raged during the early part of the month, that of the 10th being the most furious and destructive known for many years. A sharp frost set in afterwards, and continued till nearly the end of the month. Vivid L on the 10th. Mean temp. 38°·9.

TENBURY, ORLETON.—A warm month with the exception of nine days from 17th to 25th inclusive (mean temp. for the 9 days 23°·4.) The average temp. for the whole month was nearly 2° below the average of 30 years. At 9.30 p.m. on the 3rd the ther. stood at 58°·7, the highest December max. recorded here in 30 years. The temp. on 11 days rose above 50°, and on 20 days above 45°, while in December, 1890, it never once rose above 45°. Fog on 2nd, 17th, 21st, 22nd, 23rd and 24th; S on 12th; gales on 7th, 10th and 11th.

LEICESTER, BARKBY.—R daily for the first half of the month and during the last week, and the country very wet. A model Christmas Day; plenty of good ice; lovely rime and glorious sunshine, with hard frost. Some strong winds from 9th to 15th.

MANCHESTER, PLYMOUTH GROVE.—Dense mist on 2nd; as mild as May on 4th, 5th and 6th; very stormy on 9th, and 10th; H showers on 11th; some S and sleet on the 12th; fine winterly weather from 17th to 20th; dense fog on 21st, 22nd and 23rd; hard frost from 21st to 24th. The rest of the month very unsettled. Mean temp. 40°·5.

WALES.

HAVERFORDWEST.—This month, like the preceding one, was characterised by excess of R, violent continuous storms, and mildness. The week preceding Christmas a sudden wave of excessive cold occurred, which lasted till Christmas Day, when the old character of weather returned. On Sunday evening, the 27th, a violent squall of R, H and wind took place at 7.30 p.m., and at 8 p.m. another squall with terrific L and T.

SCOTLAND.

CARGEN.—The month was characterised by great and sudden changes of weather. The first fortnight was extremely stormy and wet, 5·05 in. of R falling. A very unusual fog (for this district) was experienced for 4 days, 22nd to 25th inclusive. A rather curious circumstance connected with the fog being that on the day it was most dense the crows belonging to the large rookery at Kirkconnell, about three miles distant, quite lost their bearings, could not find their way home, and roosted for the night in thousands on the trees round the park here. A sharp TS with heavy R was experienced on the evening of the 28th, and L was seen on the evening of the 29th and 30th.

JEDBURGH.—There was much R during the month and a great variability of temperature and range of the bar., but little or no fog. A good deal of frost, but country work went on when there were people to attend to it.

OLD CUMNOCK.—T and L on the 10th at 5.30 a.m.; S on the 13th; frost from 18th to 24th; H and S at times from 25th to 31st.

OBAN.—A most tempestuous month, with continuous heavy R throughout; saving one week in the second half, temp. high, but towards the close a gradual and seasonable fall occurred.

S. RONALDSAY, ROEBERRY.—Upon the whole a good month. Cold and more unsettled towards the end.

IRELAND.

WATERFORD, BROOK LODGE.—A very mild month; mean temp 44°·9. Some primroses in bloom in the early part. L during a gale in the night of the 11th; H showers on the 27th.

O'BRIENSBRIDGE, ROSS.—The first fortnight, and last week of the month were very wet, wild and wintry, with an interval of nine days without R, from the 16th to 24th; frost was frequent in that interval, but not severe at any time; gales from S.W. frequent and violent, with much L.

DUBLIN.—The leading features of the month were a preponderance of S.W. winds, frequent gales, heavy rains, and unsteady, but often high temp. From the 16th to the 25th, however, severe cold and dense fogs with calms prevailed. Mean temp. 43°·0, 1°·7 above the average; 6 days of frost in screen occurred, and 15 days of frost on the grass. A lunar rainbow was seen on the 15th; solar halos on 8th, 9th, 13th and 14th; high winds occurred on 14 days, attaining the force of a gale on 8; fogs on 9 days; S or sleet fell on the 11th; H on the 10th.

BALLINASLOE.—The first part of the month was very wild and wet; roads were forced up by the R in much the same way as by the action of heavy and continuous frost, and floods occurred over portions of road which have not been inundated for many years.

EDENFEL.—Mostly wet and open, except during the week ending on Christmas Day, which was remarkably fine and generally clear. Gales on 10th and 11th, followed by S on 12th, but not to last.

END OF VOL. XXVI.